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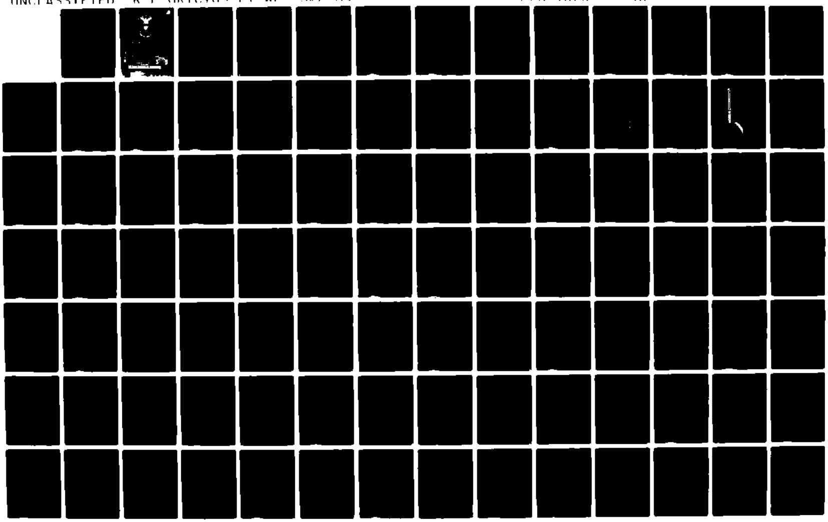

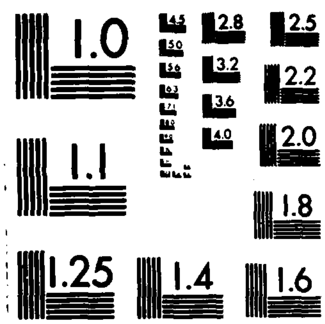

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INSTITUTIONALIZED COMMUNICATION BETWEEN
RESEARCHERS AND LOGISTICIANS:
AN EXAMINATION AND RECOMMENDATION

THESIS

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AFIT/GLM/LSM/84S-27

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INSTITUTIONALIZED COMMUNICATION BETWEEN RESEARCHERS AND LOGISTICIANS: AN EXAMINATION AND RECOMMENDATION

THESIS

Presented to the Faculty of the School of Systems and Logistics
of the Air Force Institute of Technology
Air University
In Parital Fulfillment of the
Requirements for the Degree of
Master of Science in Logistics Management

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September 1984

Preface

The purpose of this study was to validate the communication void between the research and using communities concerning logistic support areas. The study also attempted to provide a solution for bridging this communication void.

To accomplish this objective we interviewed 27 people considered experts in the logistic and research fields. During the interviews, we collected data on the existence of the communication void and possible methods or mechanisms for bringing the two communities together.

We could not have performed the research nor written this thesis without the help of many individuals, too many to mention them all. However, there are a few we must recognize. We are deeply indebted to our sponsor, Colonel John C. Reynolds and his staff for their continued support throughout our effort. We also wish to thank our advisor, Major Arthur Rastetter and our faculty reader, Lieutenant Colonel John Long. In addition, we send a word of thanks to those individuals we interviewed for taking the time to talk with us. We would like to give a special thanks to Cindi Prater, our typist, who also scheduled our interview appointments and trips, and Vail McGuire for providing recommendations on our syntax. Finally, and most importantly, we need to recognize our wives, Vicki Gricius and Mindy Herd, and our children for their understanding during our many hours of work.

Randall E. Gricius

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Abstract

This ~~study~~ thesis examined the issue of identifying logistic requirements for future systems. It focused specifically on logistics research and the perceived communication void between the research and using communities. Twenty-seven structured interviews were conducted in person to gather the data.

The interview results corroborated information brought out in the literature search indicating a lack of formalized communication links between the research and using communities. Also highlighted in the results were the problems of poorly developed or missing organizational structures which would be responsible for managing acquisition logistics of future systems. In addition the results pointed out the respondent's desires for a consolidated information source on logistics research.

The study's conclusions indicate the need for an institutionalized method of crosstalk between the two communities. The researchers propose a solution which ultimately achieves the goal of a formal, institutionalized process of crosstalk. This solution consists of a step-wise approach which addresses the problems of organizational structure, education, communication mechanisms, and a single data base. Recommendations are suggested for further exploration and refinement of the ideas presented in this study.

INSTITUTIONALIZED COMMUNICATION BETWEEN
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I. Introduction

Purpose

Quantum improvements in weapon systems durability with concurrent diminishing supportability demands are a major Air Force goal. Accomplishing this goal will require specific commitments from all involved participants. Innovation, creativity, and a willingness abandon traditional approaches to planning for Research and Development (R&D), design, manufacture, maintenance, spares, test equipment, technical data, and manpower are necessary. The Statement of Operational Need (SON) is an ideal starting point to incorporate attitude changes toward traditional logistic approaches. The personnel at Major Command levels identifying operational needs are in the best position to execute such a change (18:2-5). Past logistics involvement at this level in documenting operational needs has often detracted from the full realization of designed combat performance and sustainability (40:7). Correcting this may lie partly in awareness of the technology base and proposed advances which enhance readiness objectives. This awareness should occur and be nurtured throughout the pre-conceptual phase of a weapon systems design, including laboratory and contractor research programs (27). This study sought to uncover any interface between emerging support technologies, developed during the

pre-conceptual phase of the acquisition process, and those using command logisticians responsible for establishing the framework upon which support for a particular weapon system is built. The interface is important simply because these technological improvements are of no value unless communicated to appropriate decision makers.

General Issue

During the last twenty years, new weapon systems acquired by the Air Force have increased in complexity. Unfortunately, supportability of these systems has not kept pace with the rapid advances in functional performance (40:5). This supportability decline is causing reductions in the availability of aircraft, missiles, and satellites, seriously affecting the United States' ability to successfully wage war (38:p.3-9). Even though support planning has always been a functional element in the acquisition process, program managers usually disregard this element as an active participant (5:7; 32:2; 38:p.1-3). In an arena of competing alternatives, support issues continue to be sacrificed because they represent no eminent threat to a program's failure. More importantly, planning for support improvements is not undertaken early enough in the R&D design phases of new systems (7:xii; 38:pp.3-4 to 3-7; 42:2-6; 44:30). As a result, available technologies that could be exploited are overlooked. Department of Defense (DOD) and military leaders must continue to emphasize this important aspect of planning for and buying new weapon systems. The major cost of a weapon system does not occur during system acquisition but through operation and maintenance of the system (2:15; 8:51; 32:1; 48:5). Requirements demanding "designed in" weapon

system supportability characteristics will provide long term reductions in life cycle support costs (50:8).

The review of current literature corroborates the omission of supportability concerns in past weapon system acquisition, but also manifests a renewed interest in correcting the dilemma. During the 1970's or "Decade of Neglect" as many logisticians call it (12:48), emphasis was directed at obtaining quantities of new weapon systems. The DOD effort concentrated on fielding new weapon systems, while almost totally ignoring support aspects. This explains why logistics has typically been considered a "downstream" effort, or something that can be sorted out after the system is well defined (7:xi). The result of this strategy is weapon systems so unreliable and unmaintainable, they perform up to their designed capabilities only a fraction of the time (5:5; 39:3,6,10; 42:2; 50:2-3).

Another consequence of ignoring supportability is skyrocketing life cycle costs due to continuous expenditures for correcting operational and support deficiencies (2:13). This problem is compounded because the bulk of a system's life cycle costs are already accounted for by the logistic (operation and maintenance) component (8:51; 26:13). Expressed in percentages, the figures show that approximately 50 to 60 percent of a system's life cycle costs are consumed by this component (2:15; 33:37; 43:28). Improvements in system supportability driven into R&D and continued into the design phase, present the greatest potential for long term savings (4:13; 34:4; 49:8). Realization of these cost savings, brought about by utilizing front-end logistics planning that impacts R&D and design, and then sticking with them, is attracting the attention of

high level executives from many professional fields. Elevating and sustaining logistic issues at the same level of importance as functional performance, cost, and schedule during the acquisition process is now a priority goal. Senior DOD and military leadership has expressed a firm commitment to this objective (15; 27; 36). They are not only seeking equality for support in system planning and decision trade-offs, but expressing a desire for continuing innovations in this area. Independent research and development (IRAD) programs by defense contractors and internal DOD laboratory projects are reflecting more emphasis on technology areas in order to increase mission reliability; reduce dependence on support equipment, spares and repair facilities; and reduce overall manpower levels (27).

Acknowledgement of the need for supportability is only the first step in enhancing combat capability. Correspondingly, the need for improvement in logistics must also be recognized and advancing technology is the key (32:1-6; 42:2-4). Both civilian industry and the military have made significant progress in increasing the mean time between failure (MTBF) on limited types of electronic equipment (50:2). Other related areas hold similar promise for quantum leaps in system readiness and combat durability (42:7-8). However, all of these improvements are ineffective unless the acquisition process incorporates these issues as an equal partner. Historically, system designers and their superiors have emphasized functional performance characteristics at the expense of other considerations, particularly the support/ logistics factor (51:4). Today, successful improvements in weapon system design dictate changes that include mandatory front-end participation by

logisticians (21). Implementing this resurgent philosophy becomes the challenge for DOD and industry alike.

Problem Area

The failure to preplan for logistics in future weapon systems will result in increased life cycle costs and reduced readiness (8:51; 32:1; 38:p.3-9). Surprisingly, with all the rhetoric and controversy surrounding high expenditures within the defense budget, there has been no noticeable public outrage over the billions of dollars being spent to support fielded systems (46). However, concerned managers recognize this growing cancer and are ready to arrest it. Another major concept concerning decision makers is system readiness. In the past, placing boundaries around or identifying specific variables constituting this concept has been extremely difficult to articulate in quantifiable and measurable terms. Incorporating availability into the definition of performance may hold the key (6:5).

Performance can no longer be expressed solely in terms of air vehicle characteristics such as velocity, rate of climb, and acceleration. Integration with support characteristics, implying a new definition of weapon system performance, will ensure improved system readiness (6:vi). Reversing past practices requires committed early-on consideration for logistics in the R&D and design phases.

Achieving progress will require those responsible individuals involved in systems acquisition to reassess their contributions and make changes where necessary. Typically, major command personnel or "users," initiate the need or request to counter a threat (18). Logically, these same Air Force users are equally responsible for identifying logistic

requirements and assigning them equal priority as that of functional performance, cost, and schedule. Past attempts to quantify these requirements have resulted in vague, unspecified, and undefendable traits (40). This failure to identify quantifiable logistic demands within acquisition documents targets supportability issues to be traded away in favor of more quantifiable functional performance needs (40:11).

One of the more important documents used for requirement submittal is the SON (18). Developing clear and defendable inputs is the initial step toward implementing current philosophy concerning weapon system readiness and the support arena. Knowledge of evolving technologies will foster improvement in the breadth and depth of logistics definition of requirements in this document. Put another way, inadequate knowledge of advancing support technologies is emerging as a major stumbling block, impeding the development of innovative inputs (42:9). The problem is linking or communicating IRAD and Air Force laboratory project content and break-throughs to the logisticians preparing inputs to SONs and other acquisition documents (42:9).

Problem Statement

The Air Force logistics community does not have the knowledge of, nor visibility into, generic technologies being developed prior to and during the pre-conceptual phase of a weapon system.

These new technologies are providing immense advances in functional performance aspects of new weapon systems, as well as in support issues. However, supportability enhancements are still being hampered by a basic ignorance and a lack of accessibility to these new technological developments. Those indviduals within using commands responsible for

logistics concept development are the ones most adversely affected by this void, since they are the key players in the SON process who require visibility, understanding, and trust of established or potential technological breakthroughs in order to put them to use. Major reductions in logistic elements in future combat environments will require vigorous and immediate application of advanced technologies.

Research Objective

The research objective is to discover methods or alternatives which could possibly bridge the information void between the research and using communities.

Scope

Currently, numerous agencies within the DOD could be examined to determine their enactment of the readiness and logistic issues within the Acquisition Improvement Program. This study will focus on two of the agencies, namely, the Air Force research and using communities. An underlying theme of this project is emphasis on, and consideration for, support planning even before the formal acquisition process occurs. To this end, an examination was conducted of the pre-conceptual phase during which major commands are analyzing their mission capabilities and identifying needs. Specific attention was given to the logistic portions of the documented need. The literature search in Chapter II details major deficiencies in this area.

These deficiencies in adequately documenting logistics requirements, combined with a concern for early logistics planning, provide a fertile field for research on, "Why is this occurring?" The area chosen for

this project revolves around the knowledge of those experienced field personnel providing inputs to SON's. Specifically, the lines of communications between these personnel and the developers of new or improved technologies are examined.

Research Question

How can the logistics community gain an awareness and understanding of emerging technologies?

Investigative Questions. The following questions probe the research question more in depth:

1. Are data bases available which list logistic projects under research, completed, or planned for future efforts?
   a. Do any manual data bases exist?
   b. Do any computer data bases exist?
2. Does a single manager exist within the Air Force for logistics improvement research?
3. What agencies conduct logistics improvement research?
4. Are manual report project summaries or interim reports on logistics improvement issues published monthly, quarterly, annually or at all?
5. Are support areas receiving emphasis?
6. Do agencies conducting research and development have any interaction at all with using commands?
   a. What interface exists?

Methodology

An overview of the methodology, more fully developed in Chapter

III, is presented here. Basically, the methodology attempts to answer the research question and objective by collecting data through personal interviews with experts from using command logistic planners and researchers in the research community. The interview consists of eight open and closed ended questions with each interview lasting approximately 30-45 minutes. Interviews were scheduled two weeks in advance. One week prior to the interview, a copy of the questions was sent to each respondent, allowing the individual ample time to familiarize himself with subject area.

Definitions

1. Research Community: Designated complex of DOD Laboratories, plus IRAD efforts and ancillary activities, directed toward increased knowledge of natural phenomena and environment. These efforts contribute to the state-of-the-art solutions to long term defense problems in such areas as physical, engineering, behavioral, and life sciences.

2. Using Community: Those commands, units, or elements which will be the recipient of information or services furnished by the research community. Included are Tactical Air Command (TAC), Strategic Air Command (SAC), Military Airlift Command (MAC), Air Training Command (ATC), Air Force Systems Command (AFSC), Air Force Logistics Command (AFLC), Air Force Communications Command (AFCC), Headquarters United States Air Force (HQ USAF), etc.

3. Logistics Research: Research, study, or technology development efforts conducted to enhance the supportability to weapon systems. These efforts fall in to two distinct categories. The first, direct

logistics research, includes efforts to identify and evaluate logistics problems and develop feasible alternative solutions. On the other hand, applied logistic research includes efforts which consider the logistics impact throughout the design spectrum of a new weapon system.

4. Pre-Conceptual Phase: That period of activity prior to Milestone Zero of the acquisition cycle where the genes of a new weapon system are formed.

II. Literature Review

Method of Treatment and Organization

This review is divided into six sections, with each section presenting a representative sample of available material. The primary purpose of this chapter is to highlight areas which could be considered products of the knowledge void between the research community and logisticians within the using community. The chapter starts with a brief delineation of the acquisition process phases. Special emphasis is placed upon the distinction between formally recognized phases, which are subsequent to Milestone Zero, and the pre-conceptual phase which consists primarily of research and engineering work conducted before Milestone Zero. The second section uncovers some examples of problems that have been caused by poor supportability planning. Section three investigates the rising costs involved in supporting modern day weapon systems. Section four reviews the new philosophy being put forth by our government and DOD policy makers in an effort to curb the planning problems and rising costs. Inherent in this new philosophy is the exploration of emerging technologies being produced by the research community. Section five presents a brief overview of new technologies that are available today, but that are not being utilized by the logisticians who are planning the support requirements for new weapon systems. The sixth section delves further into the lack and inefficiency of requirement identification for logistic improvements. Each of these six areas alone contributes information toward verification of the knowledge void existing between the using and

research communities. Integration of this information points toward the need for an indepth look at bridging the void between these two communities.

The Acquisition Process

The acquisition life cycle of a major system is commonly thought of as four phases and the respective milestone decisions required to progress (see Figure 1). The researchers have determined that this formal structure is incomplete, lacking the crucial pre-conceptual phase which is a major contributor to system acquisition. This section will briefly describe each of these phases and the problem of incorporating the pre-conceptual phase as an integral part of the acquisition process.

According to Dyke McCarty, Professor of Systems Acquisition at the Air Force Institute of Technology (AFIT) (31), the formally recognized system acquisition life cycle is basically a logical progression of activity starting with concept formulation and ending with operational deployment. Milestone Zero, or the program initiation point, is the validation of a stated need by an appropriate authority. With this approval, the program moves into the concept exploration phase. At this point, alternative solutions are identified and explored. When the competitive exploration of alternative system concepts reaches the point where demonstrations are warranted, another approval request is made to the appropriate authority. This constitutes Milestone I, also known as the requirement validation decision. An affirmative response moves the program into the demonstration and validation phase where the definition

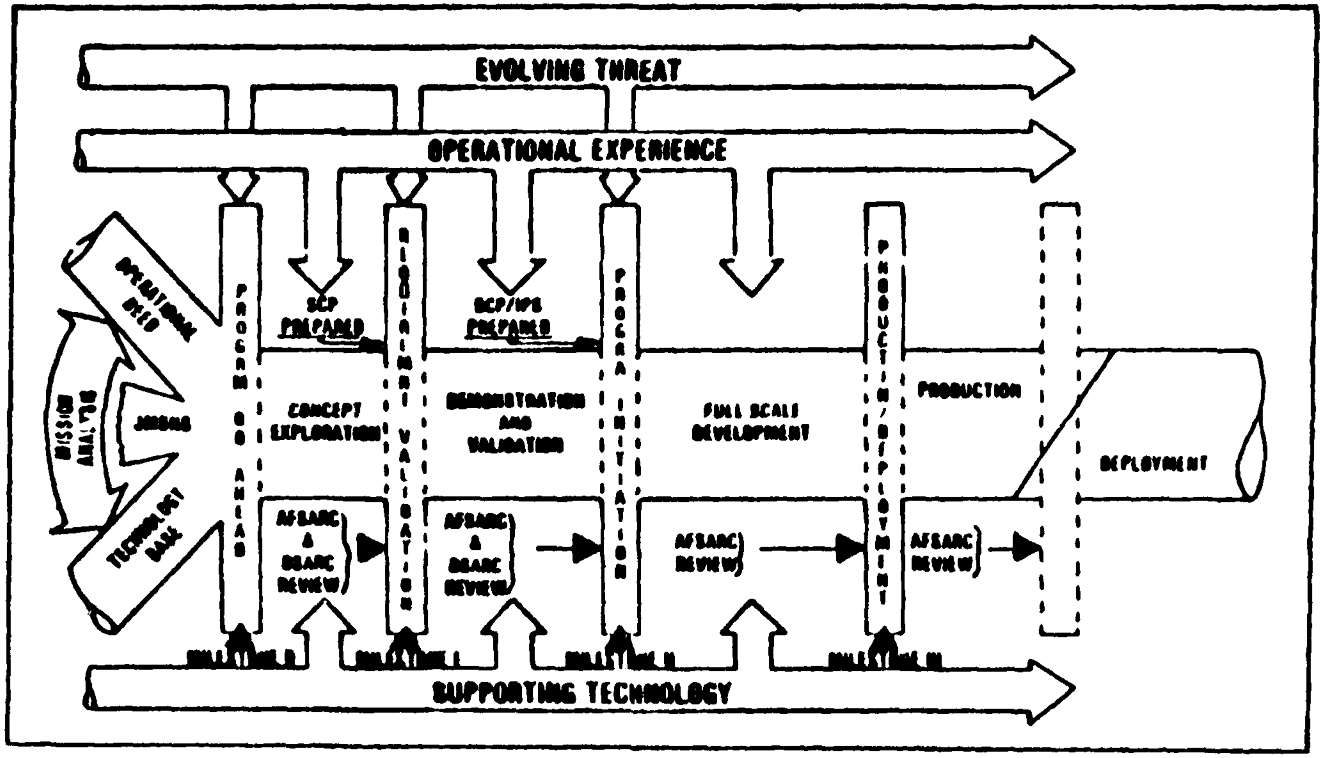

Figure 1. Traditional Acquisition Life Cycle (31)

of selected alternatives is expanded. This work is usually carried out in one of three ways: hardware prototyping, simulation studies, or a combination of the two. Regardless of which method is selected, the primary objective is the reduction of technological risk and economic uncertainty through a more detailed definition of the system. A total evaluation of this phase is made in preparation for Milestone II, which is the program go-ahead decision. Within this decision is a commitment to continue the program through engineering development and acquire long lead time procurement items, along with whatever production is required to support operational testing. If the decision is made to continue, the program then enters the full-scale development phase. In this phase the system, including all essential support equipment and documentation, is designed, developed, fabricated, and tested. Satisfactory conclusion of this phase leads to Milestone III, the production/deployment decision. This decision determines whether or not the system should be produced for operational use, defines the initial quantity to be produced, and approves plans for future production. The final phase of the acquisition process is the production/deployment phase. Here, the system, including training equipment, spares, facilities, etc. are produced and provided to units for operational use (31).

Figure 2 provides a graphical representation of the pre-conceptual phase and its past relationship with the formally recognized process. Figure 3 portrays the lack of front-end considerations for designing support aspects into new weapon systems. The pre-conceptual phase is where planning needs to start. Personnel are currently initiating logistic requirements at Milestone Zero without regard to the technology

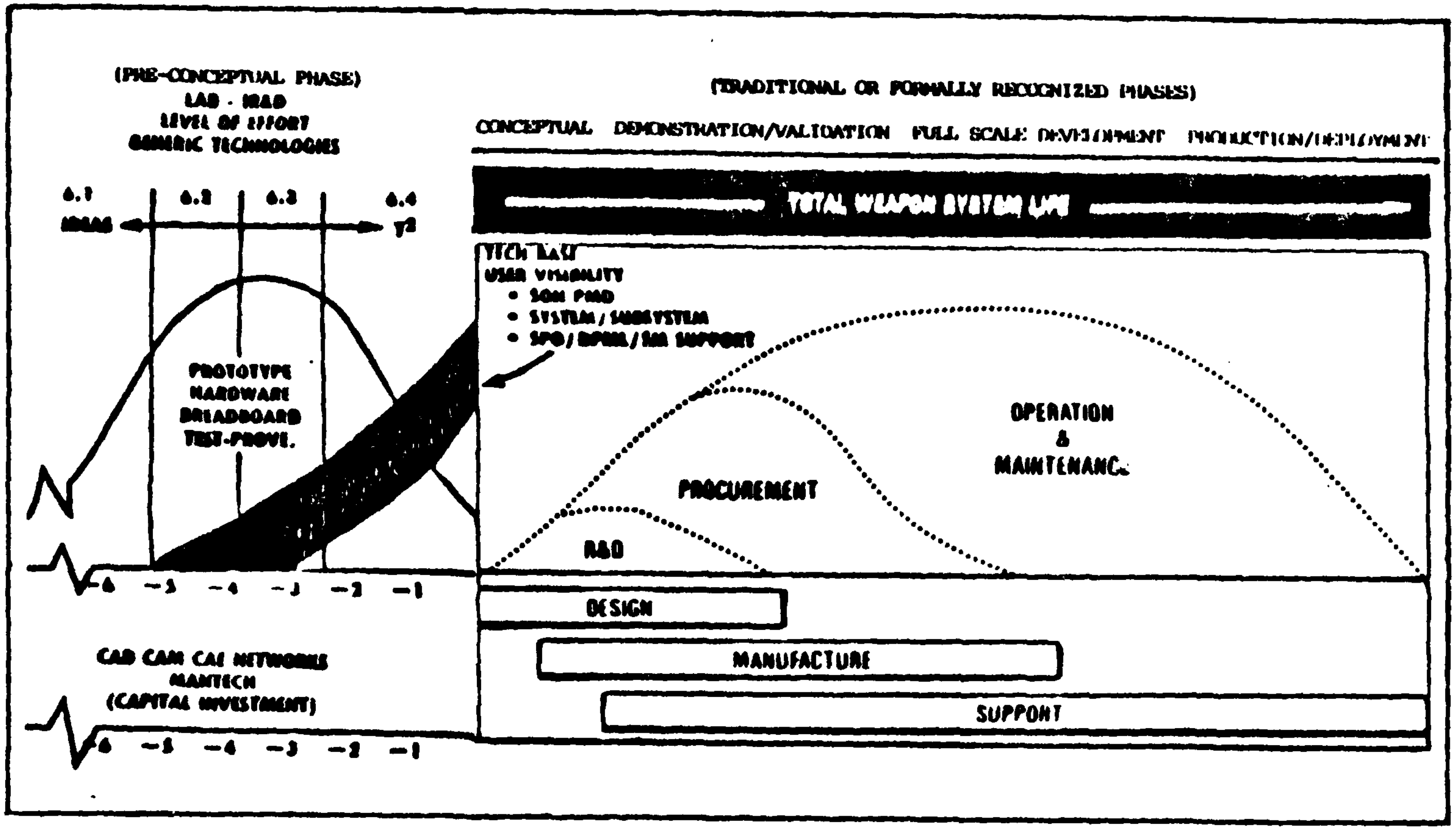

Figure 2. Weapon System Acquisition (41)

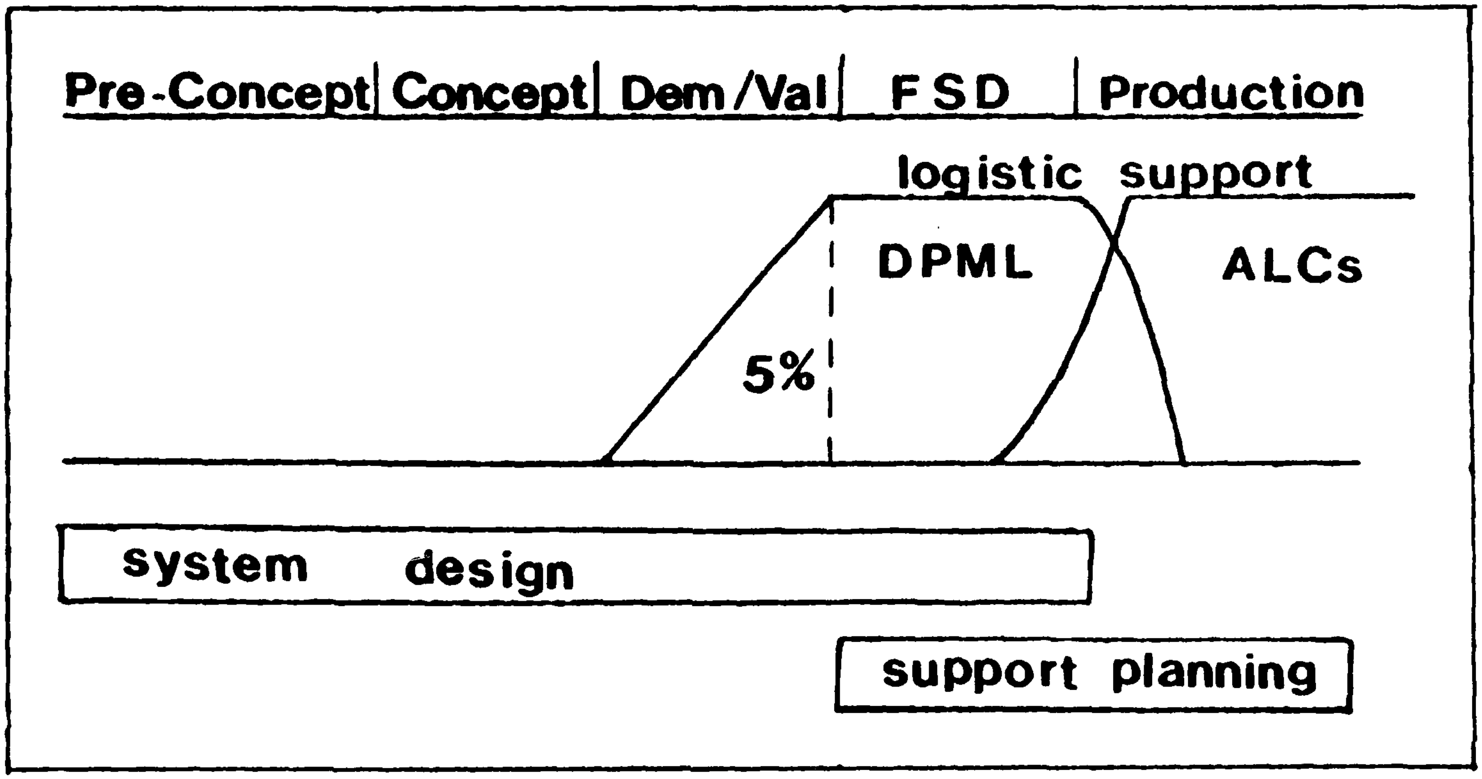

Figure 3. Past Emphasis (1)

base being generated in the pre-conceptual phase. Integrating this phase into the formally accepted process is critical to improving weapon system supportability (1).

Support Planning Problems

There are numerous examples of specific incidents that illustrate the failure to integrate supportability early in the acquisition process and the problems that can subsequently arise. Contributing to these difficulties is the fact that systems utilized by the Air Force have become more complex and the ability to keep these systems operational has become exceedingly difficult (32:1; 42:1-2). Over the decade of the 70's, the DOD concentrated on putting weapon systems on line, almost totally ignoring the support aspects. This neglect is highlighted in a recent example of the F/A-18 initial support program, which will experience funding shortfalls of 60 million dollars in FY84 and over 400 million between FY85-88 (10). This shortage of money will result in degradation of overall system capability due to a lack of spare parts (10; 30:5; 42:3). Today, the penalty for having an aircraft down for spare parts or maintenance is more severe than it used to be. General James P. Mullins (5:48), Commander of the Air Force Logistics Command, sums this up with the following:

> In the days when we had 2,000 B-47s, the grounding of any one of these airplanes because of maintenance or supply shortfalls would have cost the country only five-hundreths of one percent of its strategic penetration capability. Looking ahead just a few years, the grounding of just one B-1B for supply or maintenance will cost this country at least one full percent of its total bomber penetration capability.

Research of the existing fighter aircraft reveals that sixty to

eighty percent of the life cycle costs occur during an operation and support phase that is ever increasing in length (32:1). Clearly then, logistics support is a key consideration during the design and acquisition of a new weapon system. Although emphatically stating that logistics support shall be of prime concern, the literature (5:9; 12:48; 13:56; 30:4; 38:p.3-1; 42:1) suggests that reliability and maintainability have been, "...historically viewed by the design engineering community as second class citizens -- the Rodney Dangerfields of the acquisition world" (32:5). Often times during the acquisition process, problems arise which affect the performance capability of the weapon system. In the past, performance capability problem resolution was accomplished by reallocating money from the long range logistics support budget to the highly visible performance segment (5:7; 32:2). The result is a weapon system so unreliable and unmaintainable that it can perform up to designed capabilities only a fraction of the time, rendering the system wholly ineffective (5:5; 35:3,6,10; 42:2; 50:2-3).

Diversion of the logistic support funds in the acquisition phase increases the life cycle costs of the weapon system by driving the inherent support costs higher (5:7; 50:2). At the same time, reliability is low because it was not approached as an integral part of the system. Spare parts are difficult to maintain, not only because of the high failure rate, but also because the money for spares was utilized to work other priorities, such as performance capabilities, during the initial system acquisition (12:48; 30:4; 42:23).

Realizing its predicament, and hoping to remedy the situation, the Air Force spent more money in FY82 for spare parts than it did for new

fighter aircraft production (50:3). Similarly, the modification budget to upgrade old electronics exceeded that to develop new electronics (23; 50:3). Many of the authors (5:5; 10; 32:6; 42:3,9; 45:1-4) suggest that money spent up front on support related items during the initial design and acquisition process can pay high dividends in increased availability and decreased costs during the life of the system. A recent study completed by the Air Force Assistant Chief of Staff Studies and Analysis (5:5-7) concluded that over a ten year period, the Air Force could have saved an average of twenty-seven percent of the life cycle costs, while improving the probability of mission success fifty-four percent. This all could have been achieved by increasing the average reliability and maintainability investment by only eight percent of the present life cycle cost. This equates to a 12.8 billion dollar savings and a 390 percent return on investment. Along the same line, Hewlett Packard Electronics Company showed a tenfold reduction in chip failure rates and a 200 million dollar savings in just fifteen months by emphasizing improved quality standards (54). This is but a small sample of the areas that can potentially benefit from early-on supportability emphasis in R&D and design efforts. This emphasis must come from logisticians who are responsible for defining support requirements. The question is, then, how can logisticians more effectively define and demand the support requirements of a new weapon system?

Historical Costs

This section, focusing on money, continues to look at the past results of acquiring weapon systems which received little supportability emphasis. Needless to say, money is tantamount to the

acquisition of weapon systems. The key point of this section is to recognize that the majority of life cycle funds are spent on the support and operation of a system, not on initial acquisition. Yet, reducing system life cycle costs will require more funds to be expended up-front to enable incorporation of supportability improvements.

The bulk of evidence indicates that operation and support expenditures are the largest portion of a system's life cycle cost. Expressed in percentages, the figures showed that 50 to 60 percent of a system's life cycle cost is consumed during the operation and support of that system (2:15; 8:51; 26:13; 33:37; 43:28; 48:5; 53:29;). For example, the Marine Corps estimated in 1980 that their Tactical Combat Operations System would have a life cycle cost of $494 million with $280 million, almost 60 percent, of that going to the operation and support of the system (33:37).

On the other hand, less than 40 percent of a system's life cycle cost is spent during the research, development, and acquisition processes (26:13; 33:37). A closer look reveals that an even more minute amount of funds is directed toward actual supportability issues. In 1982, Dr. Richard D. Webster, Deputy Assistant Secretary of Defense for Logistics and Material Management found that of the 3 billion dollars the DOD spent on the contractor IRAD program, less than 2 percent was devoted to the solutions of logistic problems (48:6). The Chief Executive Officer at Northrup Corporation, Thomas V. Jones, espouses the same idea. "The U.S. Government and defense industry are spending billions... in an effort to stabilize or reduce the cost growth of acquisition. But only a fraction of that amount is being expended in operations and logistics support..." (26:13).

Taken as a whole, the research clearly indicates that operation and support expenditures are the major component of the system's life cycle cost. Operation and support can be further broken down into seven sub-components: supply support, test and support equipment, personnel, training, transportation, technical data, and facilities (7:21; 8:53). For each sub-component, there is an associated, and often hidden, cost incurred. Experience points out that far too often, these costs have either been ignored or pushed down on the priority list of requirements during the acquisition phase of a new weapon system (2:7; 4:13; 7:5; 8:51; 16:3; 26:13; 29:3; 33:34; 34:3; 35:82; 43:28; 49:7; 53:29).

Personnel and their required training are two of the sub-components where large amounts of money are spent. The Air Force Logistics Long-Range Planning Guide states that 43 percent of the total Air Force military personnel and over 50 percent of the enlisted force were devoted to performing the logistics mission in 1980 (16:1). One author, James Seger, estimates maintenance manhours account for over 40 percent of the operations and support cost (43:28). Similarly, more than 60 percent, including maintenance manhours, of the operating and support costs of most systems are related to manpower (49:7).

The U.S. Navy has two illustrative examples of manpower not receiving proper exposure in the acquisition process. During the contract competition for a new amphibious class ship in 1967, the initial estimate of the ship's manpower requirements was 502 personnel. By the time the ship completed its at-sea manpower validation in 1976, the figure had climbed to 842. Similarly, the initial assessment of manpower requirements for the new Spruance Class destroyer identified

positions for 242 personnel. However, operational capabilities added during the ship's development expanded the destroyer's manpower requirements to 311 even though it was designed for fewer than 300 bunks (49:7).

Another component of the operation and support phase that has been neglected is test and support equipment. Like manpower, test and support equipment can be buried in the design and engineering activity for the prime system (35:83). The Industry/Joint Services Automatic Testing Report states that the services spent more than 3 billion dollars annually on automatic test equipment. Despite these high expenditures, much of the equipment does not provide adequate testability which is further complicated by test equipment changes resulting from prime system modifications. The pattern in the past has been that of test equipment modifications lagging behind the prime system (35:83).

A poorly performing test station will have a negative impact on spare parts requirements. This makes a bad situation worse because for many systems, the spares requirement issue has not been adequately addressed during the acquisition phase to begin with. General James P. Mullins, Commander of the Air Force Logistics Command, sums it up best: "Just consider the ongoing shortfalls in exchangeable spares for the F-15. What we're doing makes as much sense as buying an expensive portable radio with just one set of batteries and no plan to replace them when they wear out" (34:9).

While these and other components of operation and support costs are readily observed, there are two concepts that underly them all. Reliability and maintainability of a system and its sub-systems are

directly related to component, and subsequently, operation and support costs (7:25; 9:1; 19:694).

According to a Northrup Corporation study, only 28 percent of all aircraft failures are induced failures attributable to maintenance errors, secondary failures unrelated to design, foreign object damage, operation outside design parameters, or handling abuse. The remaining 72 percent of failures are "equipment-inherent," the majority of which are the result of design compromises, deficiencies in technology or manufacturing, or improper instructions for maintenance and repair (26:14). By failing to recognize reliability and maintainability during the acquisition phase, the number of failures increase and the time to correct the failure increases (2:13; 7:11-17; 9:11; 19:693; 26:14; 29:3). As a result, the number of spares needed to compensate for a rising failure rate increases (2:15; 34:4). Furthermore, higher failure rates require more manpower and associated training to return the system to an operational state (4:1; 43:28; 49:7). Finally, reliability and maintainability affect test and support equipment in two ways. First, a higher failure rate forces the need for more equipment and manpower. Second, reliability and maintainability affect the test equipment itself. If the test equipment is broken then it cannot be used to repair prime equipment (35:82).

The literature indicates that the operation and support expenditures are the major elements of a system's life cycle, accounting for over half of the total amount spent on a system. Operation and support costs can be broken down into separate sub-components including manpower, spare parts inventory, facilities, and test and support

equipment. These components affect the overall support costs and in turn are affected by a system's designed reliability and maintainability. The literature also implies that any cost reductions will more than likely be a function of product design. It now becomes imperative that the research community pass along its new ideas and technologies to the logisticians who are in a position to demand, through requirement statements, their implementation.

New Philosophy

In response to an increased recognition of rising costs and planning problems, key individuals in the DOD are focusing on the importance of supportability within the acquisition process. There is also an increased interest in reversing the tendency to usurp improvements in supportability. On 30 April 1981, Deputy Secretary of Defense, Frank C. Carlucci, announced major changes (see Appendix A) both in the acquisition philosophy and the acquisition process currently practiced (36). Popularly recognized as the "Carlucci Initiatives," these thirty-two decisions address the major problems in systems acquisition (17:pp.9-24 to 9-25). Decisions nine, twelve, sixteen, twenty-one, thirty, and thirty-one all reiterate the theme of support considerations (36).

It is becoming increasingly evident that high performance demands readiness. Exploitation of advanced technology in new high performance systems increases reliability, maintainability, and useability standards. A support strategy focusing on reducing the current support structure's vulnerability is evolving right along with these technological enhancements (25:13-14). According to Norman R. Augustine

(14), Chairman of the Defense Science Board, the function of support strategy is to: "design reliability into systems at the beginning-test--redesign-retest until readiness objectives are adequately met."

Achieving the same technology advances for supportability that functional performance issues are receiving requires a stronger readiness proponent, not only within the acquisition system, but also in the Planning, Programming, and Budgeting System (PPBS). General William D. DePuy (15), USA(Ret), chairman for the Defense Science Board 1981 Summer Study on Operational Readiness with High Performance Systems, recommended that manpower, personnel, training, and logistics agencies be guaranteed a powerful voice at the front-end of the acquisition process, including the Request for Proposals (RFPs), source selection, and system design. He also suggested increased visibility, at all appropriate management and operating echelons, of system-by-system readiness and support requirements. Paralleling the importance of increased advocacy, is the commitment to spend necessary funds to provide the personnel, spares, training, and documentation required to complement the system hardware and software. Consideration of these factors must begin prior to the concept definition phase and continue throughout the acquisition program. Realistic assessments of associated system support is required early in order to validate and justify the budget (38:p.3-4).

Military leaders are also laying foundations for improvements in support and readiness. A recent letter on increased research and development for readiness and support displays the strong interest in this area. General James P. Mullins, Commander of Air Force Logistics

Command, General Robert T. Marsh, Commander of Air Force Systems Command, General Donald R. Keith, Commander of U.S. Army Materiel Development and Readiness Command, and Admiral J. G. Williams, Jr., Chief of the Naval Material Command (27), issued this joint statement summing up the direction they desire DOD and industry to pursue:

> We agree to increase the emphasis on technology areas which can increase mission reliability, reduce dependence on support equipment, spares and repair facilities, and reduce the need for highly skilled personnel...It is important that these same objectives be reflected by defense contractors in their Independent Research and Development (IRAD) programs...Our intent is to emphasize to the DOD and defense contractor communities the critical importance of improving operational system availability by making weapon system readiness and support enhancement high priority areas for all our research and development activities.

This emphasis on and direction toward technology is critical to reducing dependency on large support tails, but attacks only half the problem. The research and development activities need the capability to transmit their ideas and information to logisticians in the using community.

Available Technology

In order to realize this goal of increased mission readiness, current and future leaders must maintain emphasis on emerging technology. While technology is creating more complex, more difficult to maintain weapon systems, it is also a key tool in improving the reliability of the new systems. The literature (10; 20; 32:1-6; 42:2-4,6; 50:7; 52:2) repeatedly focuses on technology as an area where great gains could be realized. Major General Welch (50:1), Assistant Deputy Chief of Staff for Research, Development and Acquisition, in a letter to DOD electronics contractors stated: "The current state of

reliability in military electronics is not only unacceptable it is shameful... shameful because you (electronics contractors) and I both know we could do better." High level DOD officials are now pushing technology for answers to increased system readiness. In a memorandum to the Assistant Secretaries of the Army, Navy, and Air Force, Dr. Richard DeLauer (42:6), Under Secretary of Defense for Research and Engineering, expressed the urgent need for new technologies:

> Greater effort must be applied to make technology available which can be used to increase mission reliability, reduce dependence on support equipment, and reduce the support tail, spares and repair facilties and, equally important, reduce the need for highly skilled personnel.

The Air Force, by using modern electronics, has already improved the mean time between failure (MTBF) on limited types of electronic equipment, where up to ten times the original MTBF rates have been experienced (50:2). This increased reliability improves the readiness and sustainability of the weapon system (5:4; 35:pp.1-1 to 1-3; 50:3-5).

The Navy is testing a new maintenance technique that utilizes advanced digital avionics and a new multiplex electronic bus. This method provides remote monitoring which allows the system experts to be pooled in a centralized location, thus reducing the number of skilled technicians required (28:131).

Although new technology is already creating an impact on supportability, much more can still be accomplished. Colonel John C. Reynolds, Director of the Air Force Coordinating Office for Logistics Research (AFCOLR), identifies three areas in which quantum leaps in reliability and maintainability can be achieved (42:7-8). The first element, built in diagnostics, involves built in test/fault isolation

capabilities provided by technology near validation in the very high speed integrated circuits (VHSIC) field. Inclusion of the VHSIC will greatly improve maintainability. System reliability is the beneficiary of the second element called "graceful degradation." This term refers to digital processing and redundancy that allows a system to degrade without a perceived degradation of the whole system by the operator. The last element, transparent technology, combines the first two elements and adds the human to the equation. User-friendly, automated diagnostics, coupled with man's inherent flexibility, will make the complexity of highly sophisticated systems "transparent," promoting generalized rather than specialized maintenance skills, thus reducing manpower and support base functions.

Obviously, a move to these types of technologies will cost money, and progress is being made in appropriating funds. The literature (10; 23; 37; 50:7-9) indicates that policy-makers in the DOD are willing to funnel funds into the acquisition process for buying the available technology as well as identifying funds for the research and development of new technologies. The Office of the Secretary of Defense has approved funding in both areas for FY84 with 34.4 million dollars for improved avionics electronics and propulsion technologies and 15.5 million for Research and Development (23; 37). According to Lawrence J. Korb (37), Assistant Secretary of Defense for Manpower, Reserve Affairs and Logistics, the result of these moderate expenditures: "...will have big payoff in the readiness of our next generation systems."

Therefore, the predominant problem is not that of funding, but of

generic technologies produced by the research community not being fully employed in today's weapon systems. One explanation for this oversight is that those logisticians establishing needs simply are not aware and therefore, do not request these types of improvements in the SON.

Logistics Planning

Correction of past problems and high costs, with technology as the answer, is being spurred on by current leadership. But, the technological improvements will be rendered useless unless the gap between research and using communities is bridged. This section points out the inadequacies of and frequent lack of planning for a weapon systems long term support.

A better balance among acquisition factors such as performance, cost, schedule, and supportability is demanding more attention in today's market place. System designers have frequently favored functional performance characteristics at the expense of other considerations, particularly the support/logistics factor (51:4). The community at large, industry and the Department of Defense (DOD), are slowly realizing the vital importance of logistics. There is general acceptance that stronger steps are needed to influence and control logistic characteristics during a system's early design phases (44:30). Front-end participation by logistic planners is mandatory for successful improvements in product design, specifically defense weapon systems (21). It is impossible today for a single person to have all the necessary technical and market knowledge for exploiting alternative designs. Business and technical problems are too complex. Companies

should establish and control a systematic process for planning and developing new products (11:35).

The Air Force has such a process established, known better as the "System Acquisition Life Cycle" (18:2). The first section of this chapter provided an explanation of this process. A current problem with this process is drawing out the refinement of logistic requirements for new weapon systems (in this context references are to tactical aircraft) over the entire acquisition cycle. Numerous documents are required by differing directives, regulations, supplements to regulations or operating instructions. Some of the documents containing logistics policy and/or requirements are the Statement of Operational Need (SON), Mission Element Need Statement (MENS) [now known as the Justification for Major System New Start (JMSNS)], Request for Proposal (RFP), Preliminary Statement of Operational Concept (PSOC), Decision Coordinating Papers (DCP), Integrated Program Summary (IPS), Program Management Directive (PMD), Integrated Logistics Support Plan (ILSP) and the Statement of Operational Concept (SOC) (24). These documents are required at different times for various purposes throughout the acquisition cycle. They cover the entire spectrum, from analysis of a deficiency in mission capability to production and deployment of the identified system (22:3). These procedures and documents tend to promote identification and trade-off of functional performance parameters during design development. Logistics is typically considered a "downstream" effort, to be sorted out after a system design is well defined (7:xi). Mr. Wendt, President of Sperry Division, summed it up in this fashion, "The primary measure of worth of a system will always

be performance: All other measures must be secondary" (51:4).

The PSOC and resulting SOC are good examples of the ineffectiveness of Air Force procedures to consider logistics supportability and readiness early-on in system design. The PSOC is a key document enabling the "user" to state his employment, deployment, and support concepts which directly influence the design (3). The PSOC and SOC should lay the foundation for and be a driver in determining what goes into the RFP, DCP, and ILSP. In reality the PSOC and SOC have little impact because they are required too late in the cycle and are usually lacking in detail (3).

Logistic requirements can be expressed at the same time the need is identified. One vehicle for accomplishing this objective is the Statement of Operational Need or SON (18:2-4). These requirements, technically known as operational suitability requirements, have historically been defined with less specificity and quantification than their functional performance counterparts (40:3). This has been true particularly during early stages of the acquisition cycle. Some types of requirements that could and should be addressed within a SON are mobility, ground survivability, sortie generation, equipment reliability, maintainability, manpower, availability, etc. Mobility, sortie generation and ground survivability were selected and examined in ten tactical aircraft need statements dating from 1966 to 1981. No quantifiable constraints nor effective expression of desires were uncovered in any of these (40:7). Even in those instances when logistic needs are included, there is seldom any prioritization scheme to establish importance among them. Worse, they are hardly ever integrated

into a priority list with the functional performance factors (40:10). The lack of specific guidance for logistic characteristics within the SON also encourages operational suitability being traded away in favor of the more quantifiable functional performance needs (40:11). The result of this inattention becomes obvious when scanning the support posture of some of these aircraft. For example, it takes at least three C-141's to transport a single F-15 Avionics Intermediate Shop (AIS) to a deployed site. This consists of one station for the tactical electronic warfare equipment plus four manual and three automatic stations for other avionics and requires 4,500 square feet of level, air-conditioned floor space (6:3). Another example is the F-16 which relies on unusual and hard to handle support materials such as compressed nitrogen, hydrazine, and halon (6:12). Trying to maintain these aircraft in a dispersed Third World location will pose serious liabilities. Availability, storage/handling, and specialized equipment and people all present a difficult challenge. Improving on operational suitability requirement expressions in the appropriate planning documents can significantly improve management's attention to front-end logistic concerns.

One more problem to highlight is the perceived unimportance of logistics in the definition of weapon system performance. A quote from a recent Rand study puts this into perspective, "In the past, definitions of weapon system performance have always stressed air vehicle characteristics (such as velocity, rate of climb, and acceleration) but have largely ignored basing and support innovations except to insure that weapon systems could operate within the existing

structure" (6:vi). Current and future environments dictate that performance considerations be expanded to include not only functional characteristics, but operational suitability characteristics as well (25:13-16).

Encouraging signs that reflect a committed effort to base design decisions on logistic factors are present. These have only surfaced in the form of policy, directive, and regulation changes (47:59). Key directives at the Department of Defense level have been revised to stress support and manpower issues. Some of these, which set policy and guidance for major weapon system acquisition, are DODD 5000.1 (Major System Acquisitions), 5000.2 (Major System Acquisition Procedures), 5000.39 (Acquisition and Management of ILS for Systems and Equipment), and 5000.40 (Reliability and Maintainability) (44:29). The intention of these actions is to increase support priorities, develop quantitative measures for logistic characteristics and upgrade manpower requirements determination (44:29). Some Air Force regulations recently changed were 800-8 (Integrated Logistics Support), 800-2 (Acquisition Program Management), and 57-1 (Statement of Operational Need) (24). The latter has received the most emphasis on implementing changes. Stronger logistic wording in the SON and MENS (now referred to as the JMSNS) is essential to improving combat readiness of forthcoming systems (24).

Industry has reacted to this shift in priorities with hesitancy and caution (51). They understand the importance of fielding systems capable of accomplishing the mission and stand ready to do their part, but are unsure of the government's commitment to implementation (51:5). This concern is highlighted when the dominant considerations for

contract award continue to be acquisition cost and performance (51:5). Little attention is given to operational suitability characteristics. To verify this contention, a survey was conducted of top management in several defense related industries. One part of the survey asked the contractors how significant they perceived the supportability area was in awarding contracts. Two-thirds of the contractors estimated supportability to be insignificant, stating that supportability influenced contract award less than ten percent of the time (51:6). This attitude is reinforced when companies responding to RFP's with innovative or improved support packages, that cost more up front, do not win contracts (51:6). The situation prevents manufacturers from sinking time, money, and expertise into research and development of support factors because they foresee no payoff.

Clearly, continuing to purchase support packages that can "get by" within today's existing structure will not lead to improved combat capability. Innovation and a new direction in planning for support is necessary. The emerging technologies produced by the research community is a possible solution only if technologies can be effectively communicated to logisticians within the using community.

Literature Ananlysis

During the 1970's or the "Decade of Neglect" as many logisticians call it (12:48), emphasis was placed on obtaining quantities of new weapon systems. However, support functions associated with these new devices were often ignored, resulting in systems incapable of delivering their designed performance due to the lack of spare parts, unavailable or inadequate support equipment and technical orders, and

longer than necessary maintenance downtime. As a consequence, life cycle costs skyrocketed because money had to be spent to correct the deficient support items.

In order to rectify the situation, logistic considerations require elevation to a level equal with performance, cost, and schedule during the acquisition of new weapon systems. Past attempts to integrate logistics in the beginning of the acquisition process have been far less than optimal. It is imperative that senior DOD and military leadership demand supportability and remain committed to paying the price in terms of dollars, schedule times, testing, and involvement. Once supportability is established as a firm part of the framework, responsible agencies need to continue improving logistic ideas during the early concept definition phase.

To continue emphasis on this issue of early design considerations for logistic factors, some type of visibility must be directed toward emerging technologies. Even though research and development has been limited in the supportability area, some progress has been made. Any progress made by the research community that goes unnoticed by Air Force logisticians will only impede improvements. Air Force members should be actively seeking knowledge and understanding of technological breakthroughs so as to refine and include these items where needed. At the same time individuals in the research community should be documenting and distributing their findings to Air Force Logisticians. Past difficulties with documentation of logistic needs for new weapon systems could be corrected with an improved communication link between researchers and logisticians.

The combination of these sections: overviewing the acquisition process, examining past supportability problems induced by this process, understanding the exorbitant costs required to support weapons output from this process, revealing a new direction in acquiring weapons, exploring some technologies that could be in use today, and finally, reporting on the inadequate requirements identification by logisticians, verifies that the emerging technological knowledge of the research community needs to be communicated to logisticians within the using community. The integration of these sections point out the need for an in-depth look at how new weapon systems are born and how insertion of robust and durable genes, sown during pre-conception, will grow supportable weapon systems equal to the threat envisioned in the twenty-first century (41).

III. Methodology

Introduction

In determining a methodology that would identify possible solutions as to how the Air Force logistics community could gain an awareness and understanding of generic technologies emerging in advance of the pre-conceptual phase of a weapon system, the researchers considered several factors. First, the researchers developed an appropriate research design to accomplish the objective of this study. Second, the population was defined and a sampling plan was established. Third, the data collection method was devised using a personal interview format. Finally, the data analysis method was determined.

Research Design

The data requirement was a function of the nature of the research. Emory (20:82) identifies two types of research, exploratory and formalized, each with its own characteristics. The distinguishing features between these two types of research are the degree of crystallization, or structure, and the immediate objective of the study. The exploratory study is ill-structured and less concerned with predetermined objectives. In fact, the primary purpose of the exploratory study is usually to develop some hypotheses for future study. Exploratory research is particularly useful when the researchers lack a clear idea of the problems they will meet in the course of the study. Through exploration, the researchers are able to develop concepts more clearly (20:84,89).

Exploratory research is best suited for expanding the horizons of,

and examining new territories in a particular field. Many times it is the first study into an area where little data has been gathered. Exploratory research does not attempt to answer specific questions, but rather provides possible avenues for future research. In a sense, this type of research establishes the foundation upon which additional research will build.

Formalized research, on the other hand, is well structured. It begins with a hypothesis and has precise procedures and sources that are clearly specified (20:84,91). This type of research focuses on a specific section of a researchable subject. It attempts to solve a small piece of a particular topic, which can then be incorporated into existing studies which provides a clearer picture of the research subject area. Formalized research is very narrow in scope and usually has quantitative data that addresses the specific area.

A review of these two perspectives led the researchers to select the exploratory design. This type of approach is most appropriate due to the nature of this study. There is no literature on methods for linking the research and using communities nor do the information requirements lend themselves to quantitative, statistical manipulation. The bulk of the data will be received in a qualitative form from experienced, knowledgeable personnel in the logistics and research fields.

Population

Lack of knowledge concerning possible alternatives combined with the need for unbiased data and an exploratory design, induced the researchers to seek those persons experienced in the logistic support

and R&D fields. Therefore, the population for this study consisted of experts within the Air Force research and using communities responsible for early identification of the supportability aspects of a weapon system.

Because this study is concerned with a knowledge bridge between the research and using communities in terms of logistic support technology, the population was narrowed to personnel in this arena. This narrowing was accomplished through a two step process. Step one focused on those agencies having direct or peripheral responsibilities for the formulation, coordination, and validation of SON's. The second step entailed identification of agencies formally recognized as part of the Air Force laboratory structure. A sample of twenty-seven positions was chosen by selecting various offices identified in AFR 57-1, Operational Requirements: Statement of Operational Need (SON), as participating in the SON process and, as a matter of convenience, those laboratories located at Wright Patterson AFB. These selections were not made based on individual characteristics, but on the importance of the job position and its inherent responsibilities to weapon systems supportability. This selected sample consisted primarily of directors and deputy directors of agencies within the two communities who were established "experts" in the field of study. To ensure the validity of the research and determine respondent qualifications, biographies were requested from each respondent. These included detailed information on career background and current responsibilities. Biographical data for all respondents was analyzed using descriptive statistics in order to validate the interviewees as experts.

Demographics of Sample Population. The following two tables describe the backgrounds of individuals within the sample population:

Table I

Summary of Demographic Data

RANK/GRADE:

L/C	Col	B/G	M/G	L/G	GM-14	GM-15	SES
*3/1	14	3	2	*1	1	2	4

*Informal discussion of topic only, structured interview not conducted

AVERAGE YEARS OF AIR FORCE EXPERIENCE: 25.4

EDUCATION/TRAINING:

Degree	BA	BS	MA	MS	PHD
	9	16	5	19	5

Professional Military Education

Squadron Officer School	12
Air Command and Staff College	11
Air War College	7
Industrial College of the Armed Forces	6
National War College	2
Armed Forces Staff College	2
Canadian National Defence College	1

Table II

Respondent's Air Force Experience
(includes past and present assignments)

JOB ASSIGNMENT	NUMBER OF PEOPLE ASSIGNED	CUMULATIVE MAN YEARS	AVERAGE PER MAN
Maintenance (Aircraft, Missile, Munitions, Comm-Elec)	12	130	10.83
Personnel	2	4	2.00
Acquisition Logistics	5	21	4.20
Transportation	0	0	0
Supply/Fuels	4	13	3.25
Logistics Plans	10	61	6.10

Table II (Cont.)

Respondent's Air Force Experience
(includes past and present assignments)

JOB ASSIGNMENT	NUMBER OF PEOPLE ASSIGNED	CUMULATIVE MAN YEARS	AVERAGE PER MAN
Procurement, Contracting, Manufacturing	4	13	3.25
Program Management	9	66	7.30
SUB-TOTAL LOGISTICS	23	308	13.39
Research/Scientists	7	95	13.57
Test and Evaluation	2	2	1.00
Development Engineers	7	39	5.57
SUB-TOTAL RESEARCH	11	136	12.36
Pilot	8	89	11.12
Navigator	5	41	7.20
Commander	4	14	3.50
Missile Operations	3	9	3.00
Comm-Elec Operations	2	5	2.50
SUB-TOTAL OTHER	18	193	10.72

Data Collection Method

This section describes the method used by the researchers to collect data. Included is rationale for selecting the personal interview, steps for validating the instrument, and an overview of the interview process used.

Personal Interview. Emory (20:294) identifies two major benefits of the personal interview, each of which strengthens its choice for this study. The greatest value of this method is the depth and detail of information that can be secured. It far exceeds, in volume and quality, the information that can be gathered by mail or telephone surveys (20:294). This benefit allowed the researchers to draw out the knowledge of the experts and helped ensure all possible alternatives

were identified. Two major drawbacks pointed out by Emory (20:295) in using a personal interview were the high costs involved and large amount of time required. The personal interview also provides the interviewer more control than other interrogation types (20:294). Because the concepts used in defining the problem were relatively complex, the additional control available to the interviewer helped in focusing the respondents toward the problem, enhancing the responses with regard to the problem statement.

Instrument Validation. The instrument (see Appendix B) was developed with questions that addressed the research question. Because of the exploratory nature of the study, content validity was chosen as the only way to validate the instrument. Validity of this type requires the use of expert opinion, and for this particular instrument, consisted of a two step process. First, the questions were reviewed by Major Art Rastetter, Assistant Professor of Logistics Management, AFIT, Captain Ben Dilla, Assistant Professor of Behavioral Science and Management, AFIT, and Dr. Robert Steel, Assistant Professor of Behavioral Science and Management, AFIT. They provided improvements on question structure and order which enhanced the internal validity of the instrument. The second step was to externally validate the instrument. To accomplish this, the interview was administered to three individuals who were part of the original population and considered experts in their fields.

Initial Interview Document. Prior to the validation process a document had to be created by the researchers. The following information reflects the first draft of the interview document:

A. biography

B. introduction

C. questions

1. Do you have knowledge of logistical projects currently under research, completed, and/or planned for future efforts? (yes/no)

   If yes:

   a. What are your informational sources or where does this knowledge come from?

   b. Are these monthly, quarterly, or annual?

   If no:

   a. Do you feel there is a need for this type of knowledge?

   b. Are you interested in obtaining this type of data?

2. Do you envision a need for a single manager within the Air Force responsible for consolidating data concerning logistical research? (yes/no)

   a. Would you expand on that answer: why is it or is it not a need? What do you think could accomplish this need?

   b. Where would such a manager fit in the organizational structure of the Air Force?

      At what level and responsible for what?

3. What agencies within the Air Force do you know of that conduct logistical research?

4. Where is the emphasis for improvements to weapon system supportability being placed?

   structures, avionics, munitions, engines, etc.?

5. Are you aware of any ongoing or recurring interchanges between the using commands and the research communities? (yes/no)

   If so, what are they?

6. How would you instigate a continual cross-flow of information between the using commands and the research facilities and laboratories developing new technologies?

<u>Step One of the Validation</u>. The initial instrument was reviewed by the three individuals mentioned above who recommended minor wording changes and the inclusion of question seven and two sub-questions in question one. In addition, question two was viewed as a possible leading question because of its directness. This could introduce bias because the respondent would tend to agree with the researchers position. Furthermore, in order to improve the continuity of the interview instrument, inclusion of the biography and background information was requested. As a result of these comments, the instrument was revised as follows:

A. Biography

In order to support the validity of this research, information on the background and qualifications of the interviewees must be collected. This information will be for documentation and support and will not appear in the report.

1. Name:
2. Grade:
3. Total years of experience:
4. Current assignment
    a. Title:
    b. Responsibilities:
5. Preceding job experience:

6. Educational experience:

B. Background

Past planning for supportability of new weapon systems was inadequate to meet demands of the forecasted combat environment. Early, prior to milestone zero, identification of logistic requirements is needed to improve the availability and survivability of forthcoming weapon systems. One way to correct the past and improve the future is the establishment of a viable and accessible interface between the research and using communities. Scientists and engineers developing generic technologies in the laboratories require a method of transferring information to logisticians within the using communities responsible for establishing support requirements in the Statements of Operational Need. To research possibilities of alternative methods, questions in the next section were designed to gather appropriate information.

C. Questions

1. Do you have knowledge of logistical projects currently under research, completed, or planned for future efforts? (yes/no)

   If yes:

   a. What are your information sources?

   b. Are these sources daily, weekly, monthly, quarterly, or annual?

   c. Are these reports accurate?

   d. Is there a need for more reports?

   If no:

   a. Do you feel there is a need for this type of information?

   b. Are you interested in obtaining this type of data?

2. It has been suggested that it might be beneficial to have a

manager within the Air Force who's job would involve responsibility for consolidating data on logistical research? (yes/no)

a. Would you expand on that answer: why do you think it is or is not a need?

b. How do you think the Air Force could meet this need?

c. If the Air Force had such a manager, where would the position fit in the organizational structure? At what level or grade and what responsibilities should be included?

3. What agencies within the Air Force do you know of that conduct logistical research?

4. Where is the emphasis for improvements in weapon system supportability being placed (for instance, structures, avionics, munitions, engines, etc.)?

5. Are you aware of any ongoing or recurring interchanges between the using commands and the research communities? (yes/no) If so, how do they occur?

6. How would you instigate a continual cross-flow of information between the using commands and the research facilities and laboratories developing new technologies?

7. What media (e.g. types of publications or data bases) would best serve to stimulate exchanges of information between logistics managers and the scientific communities?

Step Two of the Validation. The revised instrument (from step 1) was used to conduct practice sessions with three individuals drawn from the sample population. These individuals were chosen as experts

based on their backgrounds which are summarized here. All three were Air Force Colonels with an average of 23.3 years of experience. Current assignment responsibilities involve monitoring, initiating, disseminating, coordinating, managing, and implementing the broad spectrum of logistics considerations. This spectrum includes aspects such as supportability, sustainability, availability, and producibility. Previous experience of these interviewees covered a multitude of jobs and Air Force specialty codes including operations, maintenance, engineering, supply, logistics planning, joint service duty, and systems acquisition. Assignments covered positions in TAC, AFLC, USAFE, AFSC, Air Force Acquisition Logistics Center (AFALC), Pacific Air Forces (PACAF), Office of the Secretary of Defense (OSD), North Atlantic Treaty Organization (NATO), Air University (AU), and Aeronautical Systems Division (ASD). These individuals had an average of a Masters Degree and had also attended Squadron Officer School, Air Command and Staff College, and Air War College. As a result of their answers, comments, and suggestions the instrument was reworked for clarity. They also recommended including a section defining pertinent terms. The instrument found in Appendix B reflects all of the recommended changes and was the document used for all the remaining interviews.

Interview Process. The respondents were contacted by telephone and an appointment was made for conducting the interview. Colonel Reynolds, the AFCOLR Commander, was instrumental during this stage in assisting the researchers in setting up appointments. It should be noted that this assistance could possibly introduce bias in the interview results. One week prior to the interview date, a copy of the questions was mailed to the respondent, allowing him time to familiarize

himself with the problem area and formulate any ideas as to the problem's solution.

The interview session started with an introduction explaining the reason behind, and the purpose of the study. Background information leading to the formulation of the problem was explained, providing a point of reference for the respondent. The questions and answers were recorded by tape recorder to ensure all comments were included as reference material for analysis. At the end of the structured portion of the interview, the respondent was allowed to make any comment he wished regarding the problem area. It was hoped that this unstructured period would provide useful data not foreseen by the researchers.

Data Analysis

The analysis consisted of synthesizing the interview responses into plausible alternatives or methods which would answer the research question. The intent was to assimilate the data according to common responses or into general areas which would form the basis of a proposed method. Establishing predetermined categories in order to provide a framework was not feasible because of the unknown nature of the responses. However, in some cases the respondent's were pre-divided into user and research groups which provided two different views of the communication void. Further categorization was made based on the researcher's judgement, with each question handled separately. In subject areas where the questions overlapped, the researchers attempted to combine the responses.

The purpose of the interview was to poll the experts, and using their responses, develop proposed categories of methods or

alternatives which would bridge the void between the research community and the "users." Currently, there are no existing solutions to this dilemma identified in the literature. Therefore, the primary objective of the analysis is to determine if the collected data revealed any possible solutions.

IV. Interview Results

Introduction

This chapter consolidates the interviewees' responses to questions posed during the data collection process. Each section reflects responses to a particular question with the exception of the next to last, which combines questions six and seven. These two questions naturally fit together because they both investigate alternative methods or media for institutionalizing the research and using community interface.

Question One

Question one was designed to determine the respondent's knowledge base in the area of logistics research. The researchers required this data to determine if any communication concerning information on logistics research was taking place. In other words, the researchers speculated that if knowledge of logistics research was minimal then very little communication existed between the two communities. Question one stated:

> Do you have knowledge of logistics research currently in progress, completed, or planned for future efforts?
>
> If yes:
>
> a. What are your information sources?
> b. How often do you receive this information and is it adequate?
> c. Is there a need for more information?
>
> If no:
>
> a. Do you feel there is a need for this type of information?
> b. Are you interested in obtaining this type of information?

The initial responses to this question fell into three distinct areas: yes, no, and aware. Table III summarizes the results.

Table III

Respondent's Knowledge of Logistics Research

YES	AWARE	NO
18	7	2

Sixty-seven percent answered yes, seven percent answered no, and twenty-six percent answered that they were aware of logistic research efforts. Two groups of questions then sought further definition of this knowledge. Those responding yes or aware were asked the first group of follow-on questions and those answering no were asked the second group.

The first group consisted of three questions. The first question collected data about existing information sources on logistics research. Table IV depicts the information sources identified by the respondents.

Table IV

Respondent's Current Information Sources

SOURCE	TIMES IDENTIFIED
Air Force Coordinating Office for Logistics Research	10
Internal Organizational Requirements/Staff	7
Periodicals/Journals	7
Briefings	6
Reports	4
Logistics Needs Process	4
Air Force Logistics Research and Studies Program	4
Meetings	4
Independent Research and Development	3
Previous Assignment	3
Symposiums	2
Seminars	2
Program Reviews	2
Workshops	1

The second question addressed the adequacy and frequency of the identified information sources. Table V summarizes the perceived adequacy.

Table V

Adequacy of Information Received

YES	NO	NOT SURE
7	16	4

Sixteen percent felt the information received was adequate for their purposes, while seventy-four percent stated that it was not adequate or they were not sure. The frequency of information received fell naturally into three categories: frequent (more than once a month), semi-frequent (less than once a month but more than semi-annual), and infrequent (less than semi-annual). Table VI represents the frequency of information received.

Table VI

Frequency of Information Received

FREQUENT	SEMI-FREQUENT	INFREQUENT
37%	22%	41%

The third question in this group determined the respondents' desire for more information concerning logistics research. Table VII summarizes these results.

Table VII

Respondent's Need for More Information

YES	NO
10	17

Over sixty percent of the respondents felt there was not a need for more information, but that the existing information should be more structured (see Table VIII).

Table VIII

Respondent's View On Information Structure

RESPONSE	TIMES IDENTIFIED
More Structure	12
Structure OK Now	8
No Comment	7
Less Structure	0

The second group of follow-on questions had only two responses and those did not contribute to the study.

In summary, the majority of the respondents indicated they had knowledge of logistics research through a multitude of sources. The respondents did not think these sources were adequate, but at the same time did not feel there was a need for more information. Instead, they felt the need for a restructuring of existing information into an institutionalized program.

Question Two

Question two gathered information on respondents awareness of agencies conducting logistics research. The researchers felt that if the population had no knowledge of particular agencies then communication between the research and using communities probably did not exist. Question two was:

> What agencies within the Air Force do you know of that conduct logistics research?

Table IX indicates the respondents are in fact knowledgeable of agencies conducting logistics research. One questionable area of this data though was the identification of AFCOLR, which is not specifically chartered to conduct logistics research. Overall, these results indicate that some form of communication is taking place.

Table IX

Agencies Conducting Logistics Research

AGENCY	TIMES IDENTIFIED
Air Force Laboratories	25
Air Force Coordinating Office for Logistics Research	9
Logistics Management Center	7
Independent Research and Development	6
Contractors	5
Business Research Management Center	4
Air Force Acquisition Logistics Center	3
AFLC Air Logistics Centers	3
Air University- Air Force Institute of Technology	2
Productivity, Reliability, Availability and Maintainability Office	2

Question Three

Question three collected information concerning laboratory emphasis on supportability. The question attempted to validate the lack of communication between the using and research communities identified in the literature review. Question three asked:

> Are the research laboratories emphasizing improvements in weapon system supportability?

In order to analyize the data, the researchers divided the respondents into two groups: research community and using community. Respondents located in the AFALC were included in the using community. The researchers grouped the responses into yes or no categories. Table X shows the results.

Table X

Respondent's View of Laboratory Emphasis On Supportability

	YES	NO
Users	9	10
Researchers	8	0

It should be pointed out that 5 of the users who answered yes also felt that the research community was not emphasizing supportability enough.

Table X shows a definite perception existing within the research community which indicates emphasis is being placed on supportability in their R&D efforts. On the other hand, the using community did not make the same positive statement. Contrary to earlier findings, these results clearly denote a lack of communication between the two communities.

Question Four

Question four seeks knowledge of any existing formalized interface between the research and using communities. The researchers desired identification of these interchanges for two reasons. The first was to avoid recommending any existing communication methods as new findings. The second reason was to investigate the feasibility of retaining any interchanges. Question four asked:

> Are you aware of any ongoing or recurring interchanges between the using commands and the research communities?

Table XI summarizes the results.

Table XI

Respondent's Awareness of Existing Interchanges

YES	NO
9	18

Sixty-seven percent of the respondents indicated they were not aware of any ongoing or recurring exchanges of information. Thirty-three percent stated they were aware, however, the researchers felt that most of the examples presented did not qualify as institutionalized methods of crosstalk (see Table XII). Some of these

Table XII

Methods of Recurring Interchange

TYPES	TIMES IDENTIFIED
Project Status Briefings	4
Meetings	3
Working Committees	2
Deputy Program Manager for Logistics in Laboratories	2
Symposiums	2
Logistics Needs Process	2
Air Force Coordinating Office for Logistics Research	2
Seminars	1
Advisory Groups	1
Telephone	1
Technical Reviews	1
Air Force Acquisition Logistics Center/ Deputy for Advanced Technology and Logistics Strategies	1

were: project status briefings (as needed), meetings (as appropriate), working committees (on specific issues), etc. A few, brand new initiatives were brought to light that could be classified as a formalized, recurring interchange. These were: the placement of "loggie" types into the various laboratories, the creation of a new directorate in the Air Force Acquisition Logistics Center (AFALC) with the expressed purpose of laboratory interface, and a Laboratory Awareness Symposium Program.

When assessing the idea of existing approaches, the respondents' comments frequently took the form of, "hap-hazard;" "happen-stance;" "mistake;" "informal;" and "ad hoc;" when referring to current crossflow of information between the laboratories and users. Clearly, the respondents felt that there is a scarcity of a standardized communication process.

Question Five

The objective of question five was to determine if the respondents felt that the flow of information between the using and research communities needed to be routed through a centralized clearinghouse type function. Part b. of question five, which was asked only if the first part was answered in the affirmative, attempted to determine the respondents level of priority in solving the problem of a communication void. Question Five stated:

> It has been suggested that it might be beneficial to have a manager within the Air Force who is responsible for consolidating and dispersing information on logistics research. Do you think this would be helpful?
>
> a. Why?
>
> b. Where do you think such an organization would fit in the Air Force structure?
>
> - level
> - grade/rank

Table XIII summarizes the initial results.

Table XIII

Respondent's View of a Central Data Organization

HELPFUL	NOT HELPFUL	NOT SURE
17	5	5

Sixty-three percent of the respondents answered that a centralized organization would be beneficial. Of these, fifty-nine percent felt either AFCOLR or AFALC was already performing or attempting to perform this function. Eighteen and one-half percent of the respondents felt such an organization would not be beneficial, only adding to an already huge bureaucracy. These individuals felt that existing organizations

should "do their jobs," or that the flow of information could be handled within the existing structure. The remaining eighteen and one-half percent of the respondents were not sure whether such an organization would be helpful or chose not to make a statement either way.

In general, the majority of respondents felt such an organization would be useful as a focal point for collecting, translating, and disseminating data on logistics research. Table XIV depicts the rank that respondents suggested for directing this organization.

Table XIV

Director Rank for a Central Data Organization

COLONEL	GENERAL	NOT SURE
11	2	4

Sixty-five percent of the respondents felt a Colonel was the appropriate rank while twelve percent felt the agency should be headed by a general officer. The remaining twenty-three percent offered no level of command. Table XV shows the level at which this organization should be placed in the Air Force hierarchy.

Table XV

Organizational Level for the Central Data Organization

LEVEL	TIMES IDENTIFIED
AFALC	7
AFCOLR	4
Air Staff	3
Not Sure	3

Fifty-two percent of the respondents felt such an organization should cut across the entire Air Force structure and not be attached to any operational command. Eighteen percent suggested the agency fall under

the Air Staff, while forty-one percent felt it should be in the AFALC structure. Twenty-three percent of the respondents felt this organization was properly located at AFCOLR, while the remaining eighteen percent were not sure.

Question Six and Seven

The researchers designated these two questions as the focal point of this study effort in that they tried to capture knowledge concerning different or innovative methods and techniques that could improve the communications between the research and using communities. Question six and seven respectively are:

> How would you develop and implement a continual cross-flow of information between the research facilities and laboratories developing new technologies and the using commands?
>
> What media (e.g. types of publications or data bases) would best serve to stimulate exchanges of information between logistics managers and the scientific communities?

The respondents provided an abundance of suggestions and recommendations that could possibly alleviate the current communication problem. These comments were grouped into one of the following areas: improved communication mediums, education, exchange programs or a single manager for logistics R&D, as seen in Table XVI.

Table XVI

Suggested Methods and Media for Communication

TYPE	TIMES IDENTIFIED
Communication Media	
Computer Link (includes Electronic Mail)	16
Single Data Base	16
Briefings	15
Compendium	11
Meetings	10

Table XVI (cont.)

Suggested Methods and Media for Communication

TYPE	TIMES IDENTIFIED
Presentation of Issues to Highest Level	8
Reports	7
Symposiums	7
Periodicals	7
Newsletter	6
Demonstrations	5
Need for Good Salesmen	5
Seminars	5
Telephone	4
Advisory Review Groups	4
Video Tapes	4
Air Force NOW Films	1
Education	
Broaden Officers into "Generalized" Logisticians	13
Motivate Statement of Need Writers	6
Long Courses in Acquisition Logistics	5
Short Courses in Acquisition Logistics	3
Statement of Need Input Education	3
Exchange Programs	
Exchange Officer Program	9
Liason Program	7
Single Manager	
Central Information Agency	12
Information Translator Function	4
Air Force Coordinating Office for Logistics Research	3
Air Force Acquisition Logistics Center	3

The respondents pointed out various means of communication that would enhance the research and using community crosstalk. Some common or standard types included reports, periodicals, meetings, phone calls, and seminars. Those individuals interviewed pointed out that information presented in these forums would have to overcome the cultural differences between scientist and logistician. A common language or

discussion in layman's terms is a must if any constructive interchange is to take place. Some other general mechanisms of exchange were videotapes of projects, inclusion of logistics R&D efforts in Air Force NOW films, development of a logistics R&D newsletter, symposiums between the two communities, and demonstrations of problems or research results where applicable. Briefings were proposed as a fast, easy way to present information to larger groups of people. For example, a briefing road show, developed by AFWAL, which highlights their logistics R&D efforts could be taken to all the various agencies within the using community. Respondents commented that with the briefing method, the highest levels of advocacy need to be targeted. Another suggestion was a compendium of logistics R&D projects categorized by subject matter and tailored to the user. There was a great deal of concern expressed over the many and varied documents circulating within the Air Force and the desire for a single document. This suggestion primarily took the form of a consolidated data base for logistics R&D. There was speculation that this foundation would provide the logical and necessary step toward establishing a computer link between the appropriate agencies within these two communities.

The respondents identified a lack of knowledge of acquisition logistic issues, and in particular, emphasized the importance of educating the appropriate personnel. It was pointed out that most AF personnel in logistics related specialties are "stovepiped" in their particular career fields, therefore prohibiting the development of a generalized or broadened logistician. At present, no Air Force speciality code exists for the acquisition logistics field. As a

result, people who fill those positions have to be internally developed within an organization. The respondents proposed the establishment of an introductory course for personnel being assigned to jobs in acquisition logistics. Proposals included spending time in AFALC, the laboratories, AFSC/AL and AFIT.

A third major grouping of responses concerned setting up an officer exchange and/or liason program between the research laboratories and the using commands. This exchange program could provide a way for individuals to gain knowledge of and experience in each other's business and then bring that information back to their primary area of responsibility. This exposure would acclimate each individual to the other side of the fence. For instance, an individual working acquisition logistics issues on a major command LG staff would have continual interface with the research laboratories. However, because he is not sure of what the labs do he has problems communicating his needs to the research people. The exchange program would provide the LG staff member an actual working knowledge of the laboratories which, upon his return to the LG staff, would facilitate communication between the two communities.

Another segment of the exchange program suggested was to assign new engineers to the field, at the wing and depot level, for a year before they are assigned to the research laboratories. This would help the engineer get a feel for how the systems he designs will be utilized, planting the thought of logistics support into his mind.

The liason program is another way of facilitating an information crossflow between the research and using communities. These liason

officers would provide a direct and "friendly" contact for the parent organization into the wants and needs of the "liasoned" organization. For example, if the laboratories had a liason officer on the TAC LG staff, the laboratories would have a direct link into the problems with which TAC personnel were struggling. He could also inform TAC as to what projects the labs were currently working.

The respondents felt that centralization of the vast amounts of data would be an important link in improving communications. Many of the respondents concluded that there were too many agencies putting out duplicative information in a form that was unuseable. A possible solution suggested was setting up a single organization to act as an information clearinghouse for both the using and research communities. This organization would receive inputs of information and condense, categorize, and translate the information into a useable format. These inputs would not only include information from the labs concerning logistic items, but also include inputs from the using communities as to what problems required R&D solutions. The centralized function would match inputs and send the information to the appropriate agencies. It should be pointed out that some of the respondents felt the nucleus of this organization was already established at either the AFCOLR or AFALC.

Question Eight

The researchers designed question eight to allow the respondents an opportunity to express any opinions or thoughts they might have concerning the communication void between the using and research communities.

Question eight was:

> Do you have any further comments or thoughts on this topic that you would like to express at this time?

The primary area of concern presented by the respondents focused on the lack of an acquisition logistics function within the using community agencies whose prime responsibility would be identifying logistic support concepts for future systems. For example, major command LG staffs are concerned with day to day problems, and currently do not have the manpower to work acquisition logistics problems in an institutionalized framework. As a result, supportability issues for future systems often take a backseat to the existing problems and are moved down on the priority list. Eighty-eight percent of the respondents mentioned this lack of an acquisition logistics function in agencies within the using community. Thirty-seven percent of the overall sample desired such a function responsible for ensuring that supportability was designed into future systems. A further breakdown of the sample showed that seventy-five percent of the using community felt that such a function could act as the receiver of research information and in turn provide more quantifiable and defendable SON inputs. Currently, only two operational agencies within the using community have the beginnings of this type of function, but their manpower is limited to three people or less.

V. Conclusions and Recommendations

Introduction

This chapter summarizes the conclusions drawn from the interview results, presents a method of formalizing communication between the research and using communities, and recommends areas for follow-on research.

General Conclusions

There were five major conclusions drawn from the interview results. These were that a communication void did in fact exist, the structure for two way communication was lacking, education of personnel in the acquisition logistics field was needed, a single, consolidated logistics data base was required, and none of the methods suggested could solve the communication problem completely by itself.

The respondents clearly perceived a lack of communication between the research and using communities regarding emerging technologies that could improve weapon system supportability. Recurring or formalized interchanges which would promote a crossflow of information are not available. The respondents felt that existing interchanges were insufficient, describing these interchanges as "hap hazard," "accidental," "happen-stance," "mistakes," "ad hoc," etc. The sample population also espoused the desire for some form of institutionalized crosstalk in order to eliminate "chance" interchanges in their dialogue concerning logistics research.

A second major conclusion concerns a communication structure. In order to have effective communications three vital elements must be

present, a communication transmitter, medium, and receiver. Although this study was primarily concerned with establishing a communication link by using media identified through the interview process, the researchers were surprised to discover, during the course of interviewing, that a transmitter/receiver function was either missing or poorly developed within the operational command's LG staffs. This lack of a transmitter/receiver structure for managing acquisition logistics contributes immensely to the communication problem. The result is no focal point within the using community to receive inputs. The operational command's inability to create or fully support such a structure is inconsistent with the current philosophy, of quantum improvements in future weapon system durability, being presented at the highest DOD and Air Force levels. Operational commands, for the most part, establish the need (including the logistics requirements) for countering identified threats. These same commands must have a structure, parallel to that already provided for operational aspects of new systems, which ensures the entire spectrum of logistics issues is considered and developed in advance of the pre-conceptual phase.

The third conclusion reached by the researchers surmised that acquisition logistics education was essential to alleviating the communication void. Current practices tend to restrict individuals within logistics related career fields (i.e. maintenance, supply, transportation, contracting, etc.) to their particular area of expertise. These same individuals are the ones who are then required to function as generalized logisticians within an acquisition environment. A training, education or career broadening process is needed to equip

these selected personnel with the proper tools. Included in the process, would be a laboratory/research and development area focusing on advances which have logistics application. This alone would definitely promote a recurring interchange which would then result in improved supportability advocates.

The fourth major finding pointed toward a single logistics data base. The respondents were concerned about the numerous information sources and desired a consolidation wherever possible. A single data base which will provide information on logistics research and development is the ultimate goal. Peripheral sources were not discouraged nor were recommendations made to delete any of the sources identified in Table IV. The predominant mood seemed to be a desire for one central authoritative source useable by all while maintaining the other sources as augmentation material.

The final conclusion revolves around the various methods suggested and in many cases not suggested by the respondents. No new, innovative, nor magic formula's were presented which would enable resolution of the communication void. The combination of the various ideas may produce the synergism necessary to overcome this problem.

Recommended Method

The numerous and varied responses gathered by the researchers and presented in chapter four posed a serious handicap in recommending a single method. Therefore, attention turned to the possibility of several independent solutions to the stated (and real) problem of a communication void between the research and using communities. This course of action was also rejected because none of these independent

tracks were sufficiently broad enough to resolve the total problem. The researcher's determined that the answer to this dilemma lay in a structured, building block approach which combined alternatives. This decision system would enable management in both communities to institutionalize a process of information interchange. Figure Four details and describes the steps required.

Step One. The first step in achieving a formalized process of crosstalk is determining who is responsible for generating and who seeks information concerning logistics research. The researchers concluded that this aspect of the desired communication process between the research and using communities was either missing or poorly developed. To accomplish the final goal, it is imperative that a transmmitter/ receiver function dedicated to acquisition logistics be established within each agency in the using community. This function would perform duties parallel to those currently conducted in behalf of functional performance parameters. In other words, these core groups would fullfill the role of readiness and supportability advocates for future systems in line with the DOD's Acquisition Improvement Program. The reciprocal of this idea is also required within the research community, albeit to a lesser extent, because the research community realizes its responsibility for generating logistics research and is doing so. Their main problem is determining where to funnel the information they have.

Step Two. In order to accomplish the functions outlined in step one, the next step entails producing an education and/or training process for selected personnel. The recipe for accomplishing this process should contain, as a minimum, three ingredients: instruction in system and logistics acquisition, exposure to the language or

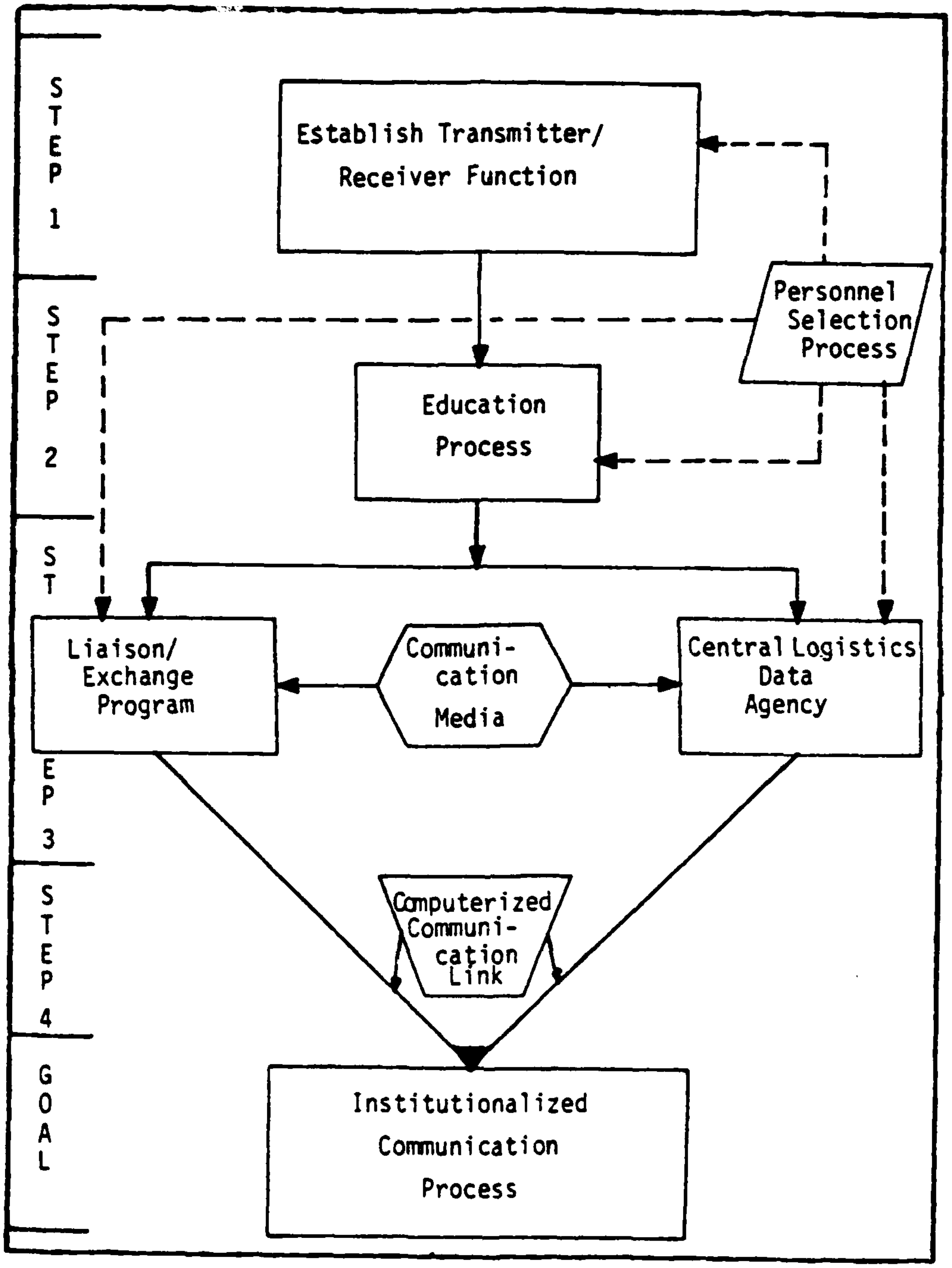

Figure 4. Method for Institutionalizing Communication Between the Research and Using Communities

cultural differences between the two communities as they relate to logistics, and scheduled temporary duty within AFALC, the laboratories, and AFSC/AL.

Formal classroom instruction already in existence needs to be reviewed for relevance to personnel working problems in the acquisition logistics field. Based on this review, courses should be revised or created to coincide with the established requirements. The researchers envision the Air Force Institute of Technology as the prime player in this process. The other two ingredients could be combined in a program which routes selected personnel through pre-determined organizations prior to arriving at their new job. This would provide these individuals with a comprehensive outlook into where acquisition logistic business is conducted. It also supplies the positive advantages of face-to-face contact with personnel at distant locations.

These first two steps constitute the basic framework needed before any methods of information interchange could be implemented. The personnel selection process is not specifically addressed in this study, except to point out that it will influence almost every step in the proposed method. The detailed actions of personnel selection are recommended for further study.

Step Three. Once the framework for communication is established, the mechanism for controlling the information interchange can be created. In this case two mechanisms are envisioned: a central logistics data agency and a liason/exchange officer program. Figure 5 shows how these two structures would fit into the communication process. The central logistics data agency should be manned with a core of "generalized" logisticians as well as liason officers from both the labs

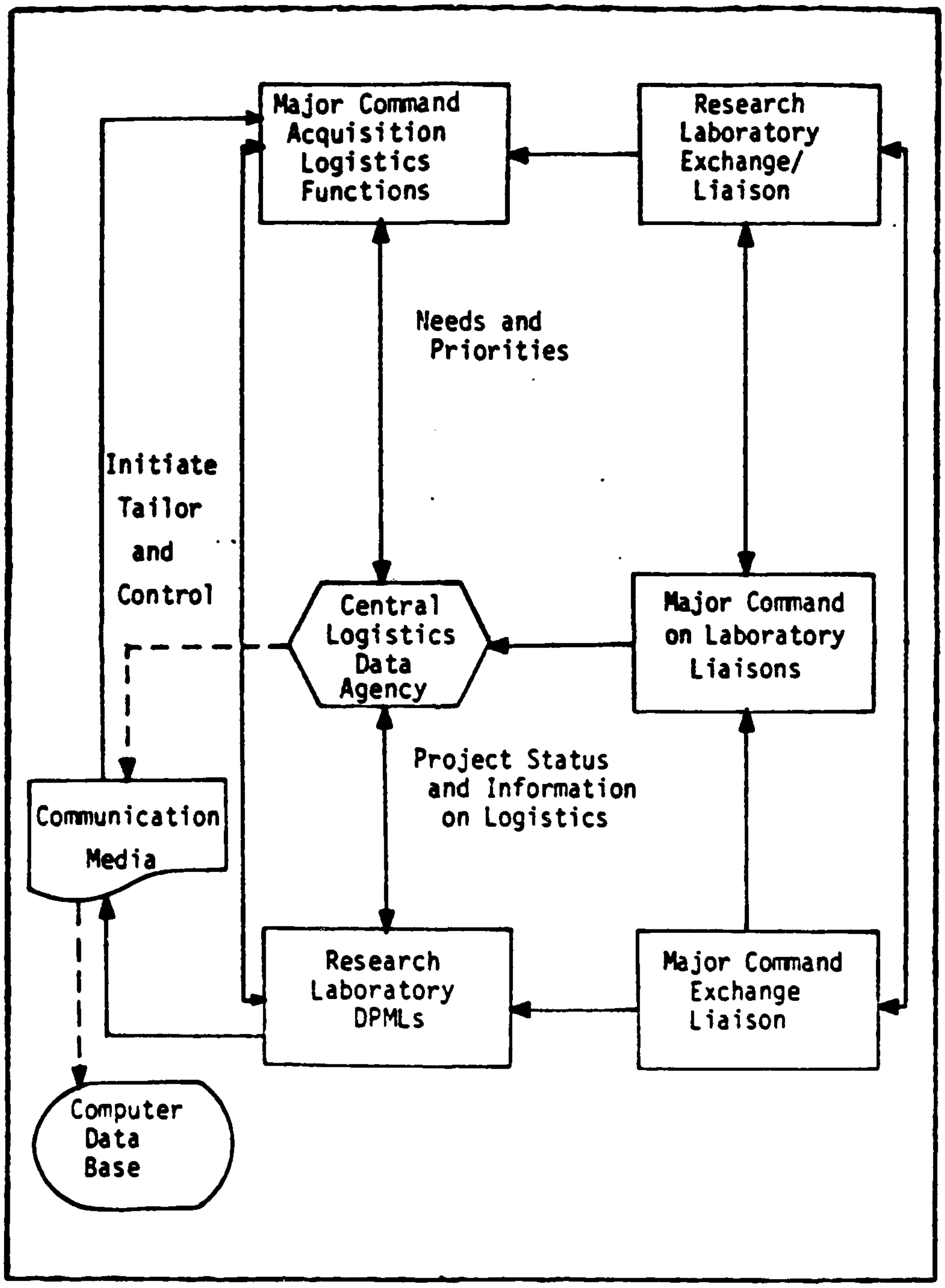

Figure 5. Central Logistics Data Agency Organization and Liaison/ Exchange Officer Structure

and major commands. People with engineering backgrounds should be included to facilitate the translator function required of this agency. This central agency would consolidate, categorize, and index information coming out of the laboratories and help the major commands communicate their needs and priorities back to the labs.

In addition to liason officers from both communities in the central logistics data agency, liason and exchange officers should be established in both the research and using communities. Logistic officers from the major commands would be assigned to research laboratory DPML's while engineers from the laboratories would be assigned to the LG staffs at the major commands.

In order to achieve optimal results, both the central logistics data agency and the liason/exchange officer program should be instituted. However, establishing only one of these mechanisms will still accomplish an institutionalized crosstalk procedure. As seen in Figure 5 the lines of communication are still intact if either structure is removed. For instance, if the central logistics data agency was not established, the liason/exchange officer system would have direct lines of communication. Likewise, if the liason/exchange program was excluded the central logistics data agency would maintain the communication link between the users and researchers.

The key to success of these functions is control. The central logistics data agency and liason/exchange program must exert control over the communication process, not just coordinate it. They must initiate communication between the two communities, translating and tailoring it to the specific audience. This will ensure only useful

and major commands. People with engineering backgrounds should be included to facilitate the translator function required of this agency. This central agency would consolidate, categorize, and index information coming out of the laboratories and help the major commands communicate their needs and priorities back to the labs.

In addition to liason officers from both communities in the central logistics data agency, liason and exchange officers should be established in both the research and using communities. Logistic officers from the major commands would be assigned to research laboratory DPML's while engineers from the laboratories would be assigned to the LG staffs at the major commands.

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The key to success of these functions is control. The central logistics data agency and liason/exchange program must exert control over the communication process, not just coordinate it. They must initiate communication between the two communities, translating and tailoring it to the specific audience. This will ensure only useful

information reaches the necessary action officers within those communities requesting data.

The media for carrying out this interaction consists of a two step process. First, the Air Force can take advantage of existing communication methods and start the process immediately. The two control mechanisms can initiate briefings, symposiums, and meetings for fast and easy dissemination of information to large groups. Videotapes, Air Force Now films, and periodicals are other means for establishing communication. Finally, the central data agency would be responsible for publishing a comprehensive compendium of logistic research projects, that categorizes projects by subject area with a brief description written in terms understood by both communities.

Step Four. The significance of step three is that the process described can be implemented immediately. The development of the single data base at the central logistics data agency which results in the compendium of logistics research, leads logically into step four (see Figure 4). All of the data should be accessible through an intelligent gateway into the various data bases where the data resides. The important considerations for this computerized communication link would include accessibility by both the users and researchers, a formatting technique that would ensure information is understood and useable by both communities, and a method of flagging specific projects to a particular agency based on an expressed interest in a logistic area.

Recommendations for Further Research

Further research beyond this study is needed in certain areas. The Manpower and Personnel Center (MPC) will have a major impact on the

implementation of any system that includes the movement of personnel as part of a solution to bridging the knowledge gap between the research and using communities. Work needs to be accomplished to determine the methods for integrating MPC into the system solution (see Figure 4). Included in this method should be a career development guide for "growing" general logisticians as opposed to "stovepiping" people into a single logistic field.

Because education of the people working in the acquisition logistics arena is paramount to their effectiveness, a study needs to be accomplished that will determine the educational requirements that could be included in a comprehensive educational program in the acquisition logistics field.

Research must be accomplished leading to a single data base that can be accessed by all agencies concerned with acquisition logistics. Areas that need resolution include a standard format that can be tailored to individual users, an indexing method to accommodate secular access, and input procedures that would ensure the insertion of only pertinent data into the data base.

Another area for further study entails examining the feasibility of implementing this proposal.

Appendix A: The Acquisition Improvement Program

Initiative Number	Initiative Title
1	Acquisition Management Principles
2	Pre-Planned Product Improvement (P3I)
3	Multiyear Procurement
4	Program Stability
5	Capital Investment
6	Budget to Most Likely Cost
7	Economic Production Rates
8	Appropriate Contract Type
9	System Support and Readiness
10	Reduced Administrative Costs
11	Technological Risk Funding
12	Test Hardware Funding
13	Acquisition Legislation
14	Reduced Number of DOD Directives and Eliminate Non Cost-Effective Contract Requirements
15	Funding Flexibility
16	Contractor Incentives for Reliability and Support
17	Decreased DSARC Data
18	Budgeting for Inflation
19	Forecasting the Business Base
20	Improved Source Selection Process
21	Standardization of Operational and Support Systems
22	Design to Cost Contract Incentives
23	Implementation of the AIP
24	Decision Milestones
25	Mission Element Needs Statement
26	DSARC Membership
27	Acquisition Executive
28	DSARC System Criteria
29	DSARC/DPBS Integration
30	Program Manager Control Over Logistic and Support Funds
31	Improved Reliability and Support
32	Competition

Appendix B: Interview Document

A. Biography

In order to support the validity of this research, information on the background and qualifications of the interviewees must be collected. This information will be for documentation and support and will not appear in the report. Please have this personal data completed prior to your scheduled interview time.

1. Name:
2. Grade:
3. Total years of experience:
4. Current assignment
   a. Title:
   b. Responsibilities:

5. Preceding job experience:

6. Educational experience:

B. Background

Past planning for supportability of new weapon systems was inadequate to meet demands of the forcasted combat environment. Early, prior to milestone zero, identification of logistic requirements is

needed to improve the availability and survivability of forthcoming weapon systems. One way to correct the past and improve the future is the establishment of a viable and accessible interface between the research communities. Scientists and engineers developing generic technologies in the laboratories require a method of transferring information to logisticians within the using communities responsible for establishing support requirements in the Statements of Operational Need. To research possibilities of alternative methods, questions in Section D were designed to gather appropriate information.

C. Definitions

1. Research Community: Designated complex of DOD Laboratories, plus IRAD efforts and ancillary activities, directed toward increased knowledge of natural phenomena and environment. These efforts contribute to the state-of-the-art solutions to long term defense problems in such areas as physical, engineering, behavioral, and life sciences.

2. Using Community: Those commands, units, or elements which will be the recipient of information or services furnished by the research community. Included are: TAC, SAC, MAC, ATC, AFSC, AFLC, AFCC, HQ USAF, etc.

3. Logistics Research: Research, study, or design efforts conducted to enhance the supportability of weapon systems. These efforts fall into two distinct categories. The first, direct logistic research, includes efforts to identify and evaluate logistic problems and develop feasible alternative solutions. On the other hand, applied logistic research includes efforts which consider the logistics impact throughout the design spectrum of a new weapon system.

4. Pre-conceptual Phase: That period of activity prior to Milestone Zero of the acquisition cycle where the genes of a new weapon system are sown.

D. Questions

1. Do you have knowledge of logistics research currently in progress, completed, or planned for future efforts?

If yes:

a. What are your information sources?

b. How often do you receive this information and is it adequate?

c. Is there a need for more information?

If no:

a. Do you feel there is a need for this type of information?

b. Are you interested in obtaining this type of data?

2. What agencies within the Air Force do you know of that conduct logistics research?

3. Are the research laboratories emphasizing improvements in weapon system supportability?

4. Are you aware of any ongoing or recurring interchanges between the using commands and the research communities?

5. It has been suggested that it might be beneficial to have a manager within the Air Force who is responsible for consolidating and dispersing information on logistics research. Do you think this would be helpful?

a. Why?

b. Where do you think such an organization would fit in the Air Force structure?

- level

- grade/rank

6. How would you develop and implement a continual cross-flow of information between the research facilities and laboratories developing new technologies and the using commands?

7. What media (e.g. types of publications or data bases) would best serve to stimulate exchanges of information between logistics managers and the scientific communities?

8. Do you have any further comments or thoughts on this topic that you would like to express at this time?

Appendix C: Related, Uncited Research Sources

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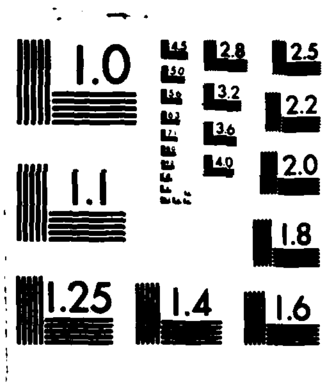

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SECURITY CLASSIFICATION OF THIS PAGE

REPORT DOCUMENTATION PAGE

1a. REPORT SECURITY CLASSIFICATION UNCLASSIFIED	1b. RESTRICTIVE MARKINGS
2a. SECURITY CLASSIFICATION AUTHORITY	3. DISTRIBUTION/AVAILABILITY OF REPORT Approved for public release; distribution unlimited.
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE	
4. PERFORMING ORGANIZATION REPORT NUMBER(S) AFIT/GLM/LSM/84S-27	5. MONITORING ORGANIZATION REPORT NUMBER(S)
6a. NAME OF PERFORMING ORGANIZATION School of Systems and Logistics 6b. OFFICE SYMBOL (If applicable) AFIT/LS	7a. NAME OF MONITORING ORGANIZATION
6c. ADDRESS (City, State and ZIP Code) Air Force Institute of Technology Wright-Patterson AFB, Ohio 45433	7b. ADDRESS (City, State and ZIP Code)
8a. NAME OF FUNDING/SPONSORING ORGANIZATION Air Force Coordinating Office for Logistics Research 8b. OFFICE SYMBOL (If applicable) AFCOLR/CC	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER
8c. ADDRESS (City, State and ZIP Code) Wright-Patterson AFB, Ohio 45433	10. SOURCE OF FUNDING NOS. PROGRAM ELEMENT NO. / PROJECT NO. / TASK NO. / WORK UNIT NO.
11. TITLE (Include Security Classification) See Box 19	

12. PERSONAL AUTHOR(S) Randall E. Gricius, B.S., Captain, USAF
John H. Herd, B.S., Captain, USAF

13a. TYPE OF REPORT	13b. TIME COVERED	14. DATE OF REPORT (Yr., Mo., Day)	15. PAGE COUNT
MS Thesis	FROM ______ TO ______	1984 September	95

16. SUPPLEMENTARY NOTATION

Approved for public release: IAW AFR 190-1.

Lynn E. Wolaver 1 Sept 84

LYNN E. WOLAVER

Dean for Research and Professional Development

Air Force Institute of Technology (ATC)

Wright-Patterson AFB OH 45433

17. COSATI CODES		
FIELD	GROUP	SUB. GR.
15	05	
05	02	

18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)

Acquisition, Logistics, Research, Communications Networks

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

Title: INSTITUTIONALIZED COMMUNICATION BETWEEN RESEARCHERS AND LOGISTICIANS: AN EXAMINATION AND RECOMMENDATION

Thesis Chairman: Arthur L. Rastetter, Major, USAF

20. DISTRIBUTION/AVAILABILITY OF ABSTRACT UNCLASSIFIED/UNLIMITED ☒ SAME AS RPT. ☐ DTIC USERS ☐	21. ABSTRACT SECURITY CLASSIFICATION UNCLASSIFIED
22a. NAME OF RESPONSIBLE INDIVIDUAL Arthur L. Rastetter, Major, USAF	22b. TELEPHONE NUMBER (Include Area Code) 513-255-5023 22c. OFFICE SYMBOL AFIT/LSM

DD FORM 1473, 83 APR EDITION OF 1 JAN 73 IS OBSOLETE.

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This study examined the issue of identifying logistic requirements for future systems. It focused specifically on logistics research and the perceived communication void between the research and using communities. Twenty-seven structured interviews were conducted in person to gather the data.

The interview results corroborated information brought out in the literature search indicating a lack of formalized communication links between the research and using communities. Also highlighted in the results were the problems of poorly developed or missing organizational structures which would be responsible for managing acquisition logistics of future systems. In addition the results pointed out the respondent's desires for a consolidated information source on logistics research.

The study's conclusions indicate the need for an institutionalized method of crosstalk between the two communities. The researchers propose a solution which ultimately achieves the goal of a formal, institutionalized process of crosstalk. This solution consists of a step-wise approach which addresses the problems of organizational structure, education, communication mechanisms, and a single data base. Recommendations are suggested for further exploration and refinement of the ideas presented in this study.